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[OFFICIAL NOTICE.]

NEW YORK MEETING—CHANGES IN HEADQUARTERS.

In the circular issued from this office September 28th, the announcement was made that the headquarters during the coming meeting would be at the Holland House. The Committee has been notified by Mr. Kinsley, the proprietor, that owing to the failure on the part of the contractors to live up to their promises, it will be impossible for him to receive the Association at the time set for the meeting. The Committee has, therefore, been obliged to make other arrangements. The Gilsey House, Broadway, corner 29th street, has been selected for the headquarters. This hotel, like the Holland, is run on the European plan, and the rate for *rooms* will be $2 per day, and upwards, according to their character.

The Committee has made special arrangements with the Sturtevant House, for the accommodation of such of the members as prefer a hotel run on the American plan. This house is also corner of Broadway and 29th street, just across 29th street, from the Gilsey. The Sturtevant House makes a special uniform rate of $3.50 per day, covering room and meals, with the express understanding that rooms shall be engaged by the members *in advance*. These hotels agree to take care of all who apply in advance for accommodations. It will be well for the members to engage their rooms *at once*. Those members who have written to the Holland House for accommodations have already been booked for accommodations at the Gilsey. ALEX. C. HUMPHREYS, Acting Sec.

Drexel Building, Philadelphia, Pa., Oct. 7, 1891.

[OFFICIAL NOTICE.]

Nineteenth Annual Meeting of the American Gas Light Association.

EXTRACT FROM THE CONSTITUTION.—"SEC. 12. *Application for Active Membership, or for Associate Membership, or for transfer from Associate to Active Membership, must be received by the Secretary at least ten days prior to the meeting at which the application is acted on.*"

The nineteenth annual meeting of the American Gas Light Association will be held in New York, on October 21, 22 and 23. The headquarters will be at the Gilsey House, Broadway and 29th street.

The members will be called to order on the morning of Wednesday, October 21st, at 10 o'clock, by the President, John P. Harbison, Esq.

The following papers are promised:

1. "Leakage," by C. H. Nettleton, Birmingham, Conn.
2. "Meter Rent, a Question of Policy," by Walton Clark, Philadelphia, Pa.
3. "The Illuminating Power of Mixture of Coal and Water Gases," by Dr. E. G. Love, New York.
4. "Theoretical Effect of Preheating Blast, Steam and Oil in Water Gas Manufacture," by Rollin Norris, Philadelphia, Pa.
5. "Lime," by Dr. A. W. Wilkinson, New York.
6. "Intensity of Light," by A. B. Slater, Jr., Providence, R. I.
7. "Manipulation of Tar from Carbureted Water Gas," by David Douglas, Savannah, Ga.

It would seem that there may be a little more than the usual amount of time to devote to the discussion of material collected in the "Question-Box." Members will please send in to the Acting Secretary, in advance, any questions they wish to submit to the meeting, through this channel. The statement of recent personal experiences and difficulties might offer good material for this purpose, and might lead to valuable discussions.

The meetings of the Association will be held in Scottish Rite Hall, corner 29th street and Madison Avenue.

The attention of members is called to the bulletin board, which will be placed in rotunda of Gilsey House. Notices in regard to the meeting, and especially changes in and additions to the printed programme will be posted thereon, and it will, therefore, be well for the members to consult it from time to time.

As much valuable time is usually lost in calling the roll, and as but

an inaccurate list is thus obtained of the members present, it is proposed this year to follow the method inaugurated at the Savannah meeting, by having the members hand in their names to an attendant as they enter the meeting room for the first time. A special blank card has been adopted for this purpose, and these cards with pencils will be handed to members outside the Hall door. Members will please write thereon their names and addresses.

The Committee of Arrangements is providing for the entertainment of the members during the time that they are not occupied with the business, which is the prime object of the meeting. The pleasure of the ladies will, as usual, be carefully provided for. No full programme has yet been furnished the Acting Secretary, but he is able to announce a banquet to be tendered the members by the local Gas Companies, on the evening of Thursday, the 22d, at the new and palatial club house of the Manhattan Athletic Club, and a river excursion for the members and the ladies on Friday, the 23d. An informal hop for one of the evenings has also been under consideration.

Members wishing to provide for comfortable hotel accommodations, should remember that New York is full of visitors at the time selected for this meeting, and, therefore, they should engage rooms well in advance. The Gilsey House has given a special rate of $2.00 per day, and upwards, according to the character of the room. This is for rooms only, the hotel being conducted on the European plan. The Gilsey House may not be able to accommodate all the members, and, therefore, for the information of those not familiar with New York, the following hotels, all fairly convenient to the headquarters, are mentioned: Sturtevant, Coleman, Ashland, Grand, Grand Union, Bartholdi, Westminster, Brunswick, Hoffman, St. James, Fifth Avenue. There are many others within convenient distance. The Committee announces that a special rate has been given by the Sturtevant House. The regular rates of the other hotels vary, and some of the members may prefer to correspond with a number of these houses before selecting. Each of the houses named will afford thoroughly comfortable accommodations.

To lessen the chance of confusion, the question of transportation is dealt with in a separate circular, enclosed.

The Acting Secretary is instructed by the Council to call the especial attention of members whom it may concern, to Sec. 51 of Constitution, printed below.

"SEC. 51. *No member who owes two years' dues shall be entitled to vote, or to participate in the deliberations of the Association, or to receive a copy of the proceedings.*"

This provision of the Constitution will be enforced at the coming meeting.

The Acting Secretary also respectfully calls to the attention of those whom it may concern, part of Sec. 52, which reads:

"Any members whose dues shall remain unpaid for a term of 3 years, may be dropped from the roll of membership by a vote of the Council."

The Acting Secretary is sorry to find that unless the payments received between now and the time of meeting render it unnecessary, he will be obliged to report to the Council a number of names that he feels sure are only on this list through inadvertence on the part of the members.

Dues are payable in advance. If not already attended to, will the members please remit for their dues, before laying this circular aside?

Transportation.

The following Passenger Associations have granted the usual concession in railroad rates, namely: The Trunk Line Association, composed of the following railroads: Addison & Pennsylvania; Allegheny Valley; Baltimore & Ohio (Parkersburg, Bellaire and Wheeling, and east thereof); Baltimore & Potomac; *Bennington & Rutland; Buffalo, Rochester & Pittsburg; Camden & Atlantic; Central of New Jersey (except locally between Philadelphia and New York); *Central Vermont; Chesapeake & Ohio (east of Charleston, W. Va.); Cumberland Valley; Delaware & Hudson Canal Co.; Delaware, Lackawanna & Western; Elmira, Cortland & Northern; Fall Brook Coal Co.; *Fitchburg; *Grand Trunk; Lehigh Valley; N. Y. Central & Hudson River; N. Y., Lake Erie & Western (east of Salamanca and Buffalo); N. Y, Ontario & Western; N. Y., Philadelphia & Norfolk; Northern Central; Pennsylvania (except locally between Philadelphia and New York); Philadelphia & Erie; Philadelphia & Reading (except locally between Philadelphia and New York); Philadelphia, Wilmington & Baltimore; Rome, Watertown & Ogdensburg (except on Phœnix Line—between Syracuse and Oswego); Western N. Y. & Pennsylvania; West Jersey; West Shore; Wilmington & Northern.

The New York and Boston lines, between the two places named, viz.: Boston & Albany Railroad; N. Y. & New England; N. Y., New Haven & Hartford; N. Y., Providence & Boston; Old Colony; Fall River Line; Norwich Line; Providence Line; Stonington Line.

The Southern Passenger Association, composed of the following companies: Atlantic Coast; Atlanta & West Point; Brunswick & Western; Charleston & Savannah; Central Railroad of Georgia; Georgia Railroad; Georgia Pacific; Norfolk & Western; Pennsylvania Railroad (lines south of Washington); Port Royal & Augusta; Raleigh & Gaston; Richmond & Danville; Richmond, Fredericks & Potomac; Savannah, Florida & Western; Seaboard & Roanoke; Shenandoah Valley (lines south of Potomac river); South Carolina Railway; Western & Atlantic Railroad.

The Central Traffic Association, covering the following ground: Bounded on the east by Pittsburgh, Salamanca, Buffalo and Toronto; on the north by the line of and including points on the Grand Trunk Railway, from Toronto to Port Huron, thence via Lakes Huron and Michigan to the north line of Cook county, Ills.; on the west by the west line of Cook county and the Illinois and Mississippi rivers, to Cairo, including Burlington, Keokuk, Quincy, Hannibal and St. Louis; and on the south by the Ohio river, but including points on either side of that river.

The Western Passenger Association, covering territory west of Chicago and St. Louis, declines to grant any concession on account of the probable limited attendance from this territory. Members interested are referred to the 5th rule below, under which they can secure special rates from Chicago and St. Louis. (The Chicago & Alton Railroad, operating in this territory, individually grants concession as herein described, from all points in Illinois to Chicago or Bloomington.)

The usual concession in railroad rates has been granted, namely, one-third off on the round trip. That is, members will pay full fare going, obtain a certificate from the ticket agent from whom they purchase their tickets, and, upon presentation of this certificate at New York, duly endorsed by Acting Secretary, they can obtain the return ticket at one-third the full fare rate. To illustrate: Suppose the regular fare from some point to New York to be $30. At the time of purchasing his ticket to New York the member pays $30 and obtains the necessary certificate from the agent; he has that endorsed by Acting Secretary, at New York; then, on presentation of the same to the ticket agent at New York, he can procure a return ticket by payment of only $10.

The following extracts from the regulations of the railroads are cited for the information of the members. *The special rates are granted subject to these regulations:*

1.—The American Gas Light Association is obliged to guarantee to redeem at full fare rates any return tickets procured by persons in attendance at meeting which may afterwards be found in the hands of "scalpers."

2.—The reduction is conditional on there being an attendance at the meeting of not less than 100 persons *holding certificates.*

3.—Each person to obtain the excursion rate must purchase a first-class ticket (either limited or unlimited) to the place of meeting, for which he will pay regular fare, and upon request, the ticket agent will issue a printed certificate of purchase of the standard form. Agents at all important stations are supplied with certificates.

4.—If through tickets cannot be procured at the starting point, purchase short-trip ticket to the most convenient point where such through tickets can be obtained, and there purchase through to place of meeting, requesting a certificate from the ticket agent at the point where second purchase is made.

5.—Tickets for the return journey will be sold by the ticket agents at the place of meeting at one-third the highest limited fare, only to those holding certificates signed by the ticket agent at point where through ticket to place of meeting was purchased, and countersigned by signature written in ink by the Acting Secretary of the Association, certifying that the holder has been in regular attendance at the meeting.

6.—No reduction of fare will be made on the return passage if the going ticket is purchased more than three days before the opening date of the meeting; except that when meetings are held at distant points to which the authorized limit is greater than three days, tickets may be purchased before the meeting in accordance with the limits shown in regular tariffs.

7.—Certificates are *not transferable*, and return tickets secured upon certificates are *not transferable.*

8.—The certificate of agent at starting point, duly endorsed by Acting Secretary of Association, must be presented to ticket agent at place of meeting, *within* three days (*Sunday excepted*) after adjournment of meeting. The return ticket will be for the line or lines covered by the going ticket.

9.—No refund of fare will be made on account of any person failing to obtain a certificate.

Important.—Be sure to obtain your railroad certificate when buying your ticket for New York; apply for ticket and certificate at least 30 minutes before train time; be sure to have the Acting Secretary endorse your certificate at New York; apply for return ticket at least 30 minutes before train time, and have your certificate with you; members will please hand their certificates to the Acting Secretary, or his clerk, upon arrival at place of meeting; *if there are* 100 members present, holding certificates, each certificate will then be properly endorsed and handed back to owner, before adjournment; keep this circular in your pocket, and apply to it if you are in doubt.

ALEX. C. HUMPHREYS,
Drexel Building, Philadelphia, Pa. Acting Sec'y.

* Only for business originating at, or destined to, stations on the direct lines of these roads between Troy, N. Y., and Montreal, Canada.

OUR CORRESPONDENT AND MR. PREECE'S "GLITTERING GENERALITIES."

Some days ago we received a check from a subscriber, who is the Superintendent of an electric lighting company in an Illinois city, in settlement of his account with the JOURNAL, and he accompanied the remittance with a trifle of good-natured railery about what he termed our oversight in failing to publish, or even to make any mention of a lecture delivered last June by Mr. W. H. Preece, Chief Electrician of the British Post Office Department, before the annual meeting of the Association of Municipal and County Engineers. The lecturer had for his theme the relative cost and merit of gas and electricity for lighting purposes, and it was but natural that Mr. Preece could only see the things brought out in his own light. We did not print the lecture at the time, for the simple reason that we failed to discover anything therein that would be of particular interest to our readers, backed up by the belief that Mr. Preece's fame as a formulator of figures, in respect to the proving by them that electricity is "almost as cheap as gas," had no stability; for Mr. Preece has "lectured" and "figured" in a similar fashion at earlier periods, and with the same unfortunate results. In any event, since our Illinois patron believes that Mr. Preece's remarks should have been aired in the JOURNAL, we "spread" them in full in this issue, so that they may again tell their story.

It will be no difficult task for a gas engineer to pick the Preece presentation to pieces, and he need not be hard set to select a paragraph in the lecture that will suit. Almost any one of the paragraphs will do for that purpose; and perhaps it will be sufficient for our criticism to call attention to his statement in comparing the efficiency values of 10 candles of gas light as against 10 candles of glow lamp light. He admits that 5 cubic feet of gas will give, through a fishtail burner—and every gas engineer in the world will here agree with him—10 candles, and then goes on to say that 33 watts of electricity "in its normal condition" will give 10 candles. Perhaps the "normal condition" factor is what he depends on to save his story, but the user of the glow lamp, and the producer of the current that feeds it as well, will not be long in determining that after the lamp has been put in duty, almost immediately after, in fact, the 33-watt lamp absorbs an additional number of watts, which waste or absorption goes on independently of the waning candle power of the lamp, until it finally must be renewed, when likely the "normal condition" is attained again. It is beyond doubt, and the records of several tests, carried on by the glow lamp makers of the United States for their own information and advantage, attest that 10-candle lamps during a life of 1,000 hours absorb an average of 58 watts over that life. In the meantime it will do to remember that the fishtail burner will be yielding its 10 candles of light from the rated burning of 5 cubic feet per hour as readily and as cheaply at the end of 5,000 hours as at the commencement of its career. Again, the fishtail burner *per se* is a decidedly cheap instrument as an emitter of a lighting current, when contrasted with the cost of its bulbous would-be rival, the incandescent electric lamp.

Take it all in all, it seems to us that Mr. Edison still has the best of the prophesy, when he remarked some years ago that gas would be the poor man's light. We hope that our Illinois friend will find comfort and pride in the Preece manifesto, for certainly gas men can afford to smile at it.

NOW FOR THE MEETING.

On Wednesday and Thursday of this week the Gilsey House and Scottish Rite Hall will be given over largely to the American Gas Light Association, the preparations for which meeting have been virtually completed for some days.

The near appoach of the appointed time brings out the regrettable fact that Secretary Humphreys will for the first time in a decade not answer to the roll call. Another misfortune threatened the Association, but happily the sharpest part thereof has been dulled; and while it is nevertheless severe enough, it is some recompense that, although President Harbison may not be able to occupy the chair continuously, he will yet be on hand. He is convalescing rapidly.

The programme is perfected, and it is a satisfactory one, in respect to its business side and the outing portion as well. With fair weather the sightseers will not go away disappointed. From the number of rooms engaged the attendance is bound to be gratifyingly large and representative as well.

THE management of the Wilmington (Del.) Coal Gas Light Company have shown a new evidence of their enterprise. On the 1st of the month the net rate per 1,000 was reduced to $1.12½.

SPECIAL WESTERN CORRESPONDENCE.

By SUNSET.

Dear JOURNAL:—Again! again! and even yet again! I wonder if the "new company" and the "opposition gas company" act ever *will* cease? The very latest is at Lansing, Mich. Supt. Cooley has been there carrying on the business with that result, satisfactory to the public and his stockholders alike, that a quiet and able administration gives. The town is of *less than* 15,000 *population*, and that an opposition gas company should seriously develop seemed entirely improbable; and yet suddenly, at this their latest point, up bob the Fahnehjelm burner and fuel gas people again, of Chicago; likewise of Jackson, Mich.; more recently of St. Joe, Mo.; would-like-to have-been-but-didn't get-there, of Milwaukee; and hope-to-be-in-the-future of St. Louis, Memphis, Chattanooga, Atlanta, and some more places, considerately not yet announced!

It is calmly announced that in this metropolis of Lansing they stand ready to put in a $125,000 plant; that they will sell gas for not over $1; and that they will supply gas to the city buildings free. Clever bait! I presume they do not consider the State Capitol building a city building. This, the biggest consumer in the place, on the free list? Well, hardly. Then gas, too, at $1 per 1,000—cheaper than in New York, Brooklyn, Chicago, St. Louis, and any quantity of other metropolises—should tickle the local councilmanic fancy. But I suppose it is the idea to furnish "blue" water gas, of 300 heat units, which, from the fact of being made a-la-Fahnehjelm, develops the remarkable faculty of giving forth 350 to 370! If so, by what hocus pocus can they ask us $1, when according to their own statements they are successfully selling at 30, 40, and 50 cents elsewhere? But why waste words? The town has 13,800 population; can any sane man consider it a fair field and a genuine legitimate attempt to establish a second company? If not, *then what is it?*

I apprehend that the Lansing Company by showing up the late entire Milwaukee proceedings, and such suggestive little points as the recent *raising* in price 33⅓ per cent. of fuel gas at Jackson, Mich., can show this latest of raids up in its true light.

It might be thought that towns of this comparatively small size were fairly secure against attacks of this sort, from sheer insignificance. Recent "exploits," however, would indicate otherwise. Take this instance of Lansing, 13,800, and a few others occuring to me; Terre Haute, Ind., 32,000; Danville, Ill., 12,000; Chester, Pa., 22,000; Akron, O., 25,000; all of these places within the year, are or have been, in various stages of the well-known contest for final supremacy, with an opposition company. Akron is a typical case. Less than two years ago the old company was unmolested; since then the "Light, Heat and Power Company" was formed, and to-day it possesses the old company—beared and bought out—and is supreme in the field where it was so plausibly announced that "they would not conflict;" "their spheres are different;" "there is room for both!" Bosh!

Some day probably we will have legislative action or Gas Commissions in all States, that will afford the security that the present Massachusetts laws give, or that England has, through Parliamentary restriction. Until then I suppose the same old game will go on and the public pay the piper! When gas laws *are* overhauled I would suggest starting with Ohio. In view of the recent Cleveland outrage I should say that that State was about as good a one as any in which to commence.

Speaking of Cleveland, "It never rains but it pours." I hear rumors of this same business, viz., a prospective "new company," there also. Fuel gas, of course; the 50 cent limit, also, of course. The idea is that in the present chaotic state of Cleveland gas troubles, a new company, *willing* to take a 50 or 60 cent rate (as the old companies are not) could have a walk-over for a franchise. Then, as franchises in cities of 250,000 can always be "utilized"—well, you know the rest. There are Eastern interests back of this. While still embryotic, it is claimed that it will develop rapidly.

That greatest of all of the late opposition companies, the Economic, is temporarily quiet. Schoolmasters have learned, though, that when an obstreperous youngster is "temporarily quiet," he is generally planning his next and a bigger move.

Speaking of Akron above, though consolidated, neither gas works will be shut down. The new Loomis works will continue to make a blue water gas, for fuel, and light with the Welsbach burner. The old coal works will make connection with the fuel mains and draw non-carbureted gas into the works. The scheme is then to add oil and carburet by passing through retorts, a la Tessie du Motay process, and distribute the high candle power gas through the old coal gas mains. Enough benches to supply coke will still be operated, and it will be in effect a

combined coal and water gas station. With a live and energetic Superintendent, as J. W. Lane is, a growing city and a cheap and high candle power gas, Akron should soon catch up with its excess capitalization; but had they not better condense their works into one.

A gas man said to me the other day: "There's one good thing about the American Gas Company; two-thirds the works operated by it are West. Ramsdell gets out here occasionally, and we *do* see something of him after all!"

The Spontaneous Ignition of Coal.

[A paper read by Prof. Vivian B. Lewes, F. C. S., before the Chemical Section of the British Association.]

In our issue for September 21st we gave the salient points in Prof. Lewes' paper on this subject. Since then we have received a revised and complete copy of the Professor's remarks, which we herewith place before our readers. The Professor said:

The researches of Grundmann, Fleck, and Richters on the Continent have done much towards explaining the somewhat complex phenomena occurring when newly-won coal is exposed to atmospheric influences. But in this country little attention has been given to the matter; and, with the exception of a report by Sir Frederick Abel and the late Dr. Percy in 1885, which is buried in a Blue book, as far as I know nothing has been published on the subject. The result is that the almost universally accepted explanation of the spontaneous ignition of coal is that it is due to the presence in it of iron pyrites—a theory which I think is entirely erroneous; and my excuse for bringing this paper before you is the enormous importance of the subject to one of the chief coal-producing districts in the kingdom.

The origin and formation of coal have long since been satisfactorily explained. We know that coal is a fossil fuel of purely vegetable origin; and we may look upon it as consisting of three distinct parts: (1) Carbon; (2) hydrocarbons—*i. e.*, compounds of hydrogen with carbon and also with traces of oxygen and nitrogen; and (3) mineral impurities, either derived from the sap of the original plants, which by their checked decay formed the coal measures, or else which have filtered into the coal during its formation, from the surrounding soil. Of these three factors, it is the carbon which forms the bulk of the coal, and which during combustion gives the chief portion of the heat that is evolved; while the hydrocarbons, as soon as the coal is heated, escape as gaseous products, and give the fuel the power of burning with flame. It is upon the proportions in which these principal constituents of the coal are present that the characteristic properties of the various varieties of the mineral to a great extent depend. For instance, in a good Welsh anthracite, the percentage of carbon is very high; while the amount of volatile hydrocarbons is very low. The result is that the anthracite is hard to kindle, and burns almost without flame; while a marked contrast to this is a good cannel, or even Wallsend coal, in which the percentage of carbon is considerably smaller, but in which that of the hydrocarbons is very high. Such coals easily ignite, and burn with a considerable amount of flame; or they can be utilized for the production of coal gas. The mineral substances, which are practically the impurities in the coal, and mainly form the ash left after combustion, consist of sulphate of lime (gypsum), alumina, silica, and disulphide of iron (pyrites), which latter forms the so-called coal "brasses" found in most seams to a greater or less extent.

Ever since Berzelius first expressed the opinion that the heat given out by the oxidation of iron disulphide into sulphates of iron might have an important bearing on the heating and ignition of coal, it has been adopted as the popular explanation of that phenomenon; and although the work of Dr. Richters clearly proves this not to be the case, the old explanation is still given. A notable exception, however, is in the case of our great metallurgist, Dr. Percy, who, as early as 1864, pointed out that probably oxidation of the coal had also something to do with spontaneous combustion—a prediction verified by Dr. Richter's researches some six years later. This disulphide of iron is met with in coal in several forms—sometimes as a dark powder distributed throughout the mass of coal, and scarcely to be distinguished from coal itself. In larger quantities it is often found forming thin golden-looking layers in the cleavage of the coal; while it sometimes occurs as large masses and veins; often from 1 inch to 2 inches in thickness. But inasmuch as these masses of pyrites are very heavy, they rarely find their way into the screened coal for shipment; many hundreds of tons of these "brasses" being annually picked out from the coal at the pit's mouth, and utilized in various manufacturing processes. If the air is dry, the pyrites undergo little change at ordinary temperatures; but in moist air they rapidly oxide when in a finely-divided condition.

It is during this process of oxidation that the heat supposed to cause the ignition is evolved. But when it is considered that some of the coals most prone to spontaneous combustion contain only 0.8 per cent. of iron pyrites, and rarely more than 2 per cent., the absurdity of imagining this to be the only cause of ignition becomes manifest. If 100 lbs. of coal were taken, and the whole of the pyrites in it concentrated in one spot and rapidly oxidized to sulphate, the temperature would barely be raised to 100° C. if all loss of heat could be avoided. Besides which, in certain manufactures, pure iron pyrites are largely used, and, when free from carbonaceous matter, may be kept in a state approaching to powder, in heaps containing many hundred tons; and although undergoing continual oxidation, I have been unable to trace a single case of heating, much less a rise of temperature which would approach the igniting point of coal. When, however, it is mixed with finely-divided carbonaceous matter, then heating and ignition are of frequent occurrence in even moderate sized heaps.

I have carefully determined the igniting point of various kinds of coal, and find that—

Cannel coal ignites at	698.0° F. = 370° C.
Hartlepool coal at	766.0° F. = 408° C.
Lignite at	842.0° F. = 450° C.
Welsh steam coal at	870.5° F. = 477° C.

So that no stretch of the imagination could endow the small trace of pyrites scattered through a large mass of coal, and undergoing slow oxidation, with the power of reaching the needful temperature.

From these considerations it is evident that we must unhesitatingly discard the old explanation of the cause of spontaneous ignition, and see what other factors we have to deal with.

Carbon, which constitutes so large a proportion of coal, is one of those bodies which possess to an extraordinary degree the power of attracting and condensing gases upon their surface; this power varying with the state of division and density of the particular form used. The charcoal obtained from dense forms of wood, such as box, exhibits this property to a high degree, while certain kinds of coal also possess the same characteristic, although to a less extent. The absorptive power of newly-won coal due to this surface attraction varies; but the least absorbent will take up 1¼ times its own volume of oxygen. In some coals, however, more than three times their volume of the gas is absorbed. This absorption is very rapid at first, but gradually decreases; and it is, moreover, influenced very much by temperature, for reasons which will be explained later. This absorption itself causes a rise in temperature which aids the action that is taking place. The rate of absorption varies with the amount of surface exposed, and therefore able to take part in the condensing action; so that when coal or charcoal is finely powdered, the exposed surface being much greater, absorption becomes more rapid, and a rise of temperature at once takes place. If charcoal is kept out of contact with air for a day after it has been made, and is then ground down to a powder, it will frequently fire after exposure to the air for 38 hours; while a heap of charcoal powder, of 100 bushels or more, will always ignite. It is for this reason that, in making the charcoal for gunpowder, it is always kept, after burning, for three or four days in air-tight cylinders before picking over, and from ten days to a fortnight before it is ground.

If newly-won coal be at once placed in a measured volume of oxygen, the gas is at first absorbed and its volume diminished. But after it has been in the gas for some little time the coal commences to give off carbon dioxide; and careful investigations show that the oxygen first taken in by the absorptive power of the carbon is now entering into chemical combination with the hydrocarbons of the coal, combining with the hydrogen to produce water, and with the carbon to form carbon dioxide, while a small proportion remains in combination in the coal itself. So that the action taking place is of two kinds—first, absorption of oxygen; and, secondly, the setting up of chemical action between the absorbed oxygen and the hydrocarbon. The absorption of oxygen gives rise to heat; and in the case of coal this rise in temperature all tends to increase the rate of the action going on. But it is rarely sufficient to bring on spontaneous ignition, as only about one-third the amount of oxygen is absorbed by the coal that is taken up by the charcoal; and the action being much slower, tends to prevent the temperature reaching the high ignition point of the coal. Air-dried coal absorbs oxygen more quickly than wet coal. The oxygen so absorbed is in a more active condition chemically than when present in the air, as, in the first place, it is in a condensed state; and, second, it is diluted with less nitrogen than in the air, as the carbon absorbs a higher proportion of oxygen than of nitrogen, and the oxygen so absorbed rapidly commences to attack the hydrocarbons present in the coal, having apparently but little effect on the carbon itself. During this action the hydrogen of the hydro-

carbons unites with the oxygen to form water, which mostly escapes as vapor; while the carbon unites with oxygen to form carbon dioxide, or carbonic acid gas. Both of these actions result in the generation of heat, which, under ordinary circumstances, is dissipated to surrounding bodies, but which, when generated in the center of a mass of fine coal (which, owing to the fact that its interstices are filled with air, is an admirable non-conductor of heat), causes a rise of temperature that in turn increases the rate of action and generation of heat until a temperature is reached at which the so-called spontaneous ignition ensues.

The most important point to be noted is the extraordinary effect which initial temperature has on the rapidity of chemical actions of this kind. At a low temperature, and, indeed, up to about 100° F. (38° C.), the absorption of oxygen, and the consequent chemical action, will go on slowly, with practically little or no chance of undue heating taking place; but directly the temperature exceeds 100° F., then, with some classes of coal, ignition is only a question of time and mass. Although the ignition point of various coals lies above 700° F., yet if many of these coals are powdered, and are placed in perforated zinc cases in masses of 2 lbs. or upward, and are kept at a steady temperature of about 250° F., in an oven, ignition will generally follow in a few hours; while between this and 150° F. it will take days instead of hours for the same result to follow. At ordinary English temperatures, the mass of broken coal must be very great before much risk of ignition is incurred.

In a paper which I read before the Institution of Naval Architects, I pointed out that in the case of coal cargoes the influence of temperature and mass could be easily traced, and that liability to spontaneous ignition increases with—

1. The increase in the bulk of the cargoes. Evidence given before the Royal Commission of 1875 showed that, in cargoes for shipment to places beyond Europe, the cases reported amount to ¼ per cent. in cargoes under 500 tons; in cargoes from 500 to 1,000 tons, to 1 per cent.; 1,000 to 1,500 tons, to 3.5 per cent.; 1,500 to 2,000 tons, to 4.5 per cent.; and over 2,000 tons, to no less than 9 per cent. Mass influences this action in two ways: (*a*) The larger the cargo the more non-conducting material will there be between the spot at which heating is taking place and the cooling influence of the outer air. (*b*) The larger the cargo the greater will be the breaking-down action of the impact of coal coming down the shoot upon the portions first loaded into the ship, and the larger thereby the fresh surface exposed to the action of the air.

2. The ports to which shipments are made; 26,631 shipments to European ports in 1873 resulting in only 10 casualties, while 4,485 shipments to Asia, Africa, and America gave no less than 60. This startling result is partly due to the length of time the cargo is in the vessel; the absorption and oxidation being a comparatively long action. But a far more active cause is the increase of temperature in the tropics, which converts slow action into a rapid one.

3. The kind of coal of which the cargo consists; some coals being specially liable to spontaneous heating and ignition. There is great diversity of opinion on this point, but it is pretty generally admitted that cases of heating and ignition are more frequent in coals shipped from east coast ports than in South Wales shipments. So much, however, depends upon the quantity of small coal present, that a well-loaded cargo of any coal would be safer than a cargo of Welsh steam coal in which a quantity of dust had been produced during loading.

4. The size of the coal; small coal being much more liable to spontaneous ignition than large. This is due to the increase of active absorbent surface exposed to the air—a fact which is verified by the experience of large consumers of coal on land. Gas managers recognize the fact that coal which has been stamped down or shaken down during storage is more liable to heat than if it had been more tenderly handled; the extra breakage causing the additional risk.

5. Shipping coal rich in pyrites (or "brasses") while wet. The effect of external wetting on coal is to retard at first the absorption of oxygen, and so to check the action; but it also increases the rate of oxidation of the pyrites, and when oxidized they swell and split the coal into pieces. This increases heating, due to the exposure of fresh dry surfaces; and it is practically only in this way that the presence of pyrites tends to swell the list of spontaneous ignitions.

6. Ventilation of the cargo. For ventilation to do any good, cool air would have to sweep continuously and freely through every part of the cargo—a condition impossible to attain in coal cargoes. Anything short of that only increases the danger; ordinary methods of ventilation supplying just about the right quantity of air to create the maximum amount of heating. The reason of this is clear. A steam coal absorbs about twice its own volume of oxygen, and takes about 10 days to do it, under favorable conditions; and it is this oxygen which, in the next phase of the action, enters into chemical combination and causes serious heating. Ventilation, such as used to be sometimes arranged for by a box shaft along the keelson, with Venetian lattice up-shafts, supplies as much air as is necessary to produce the results that end in spontaneous ignition.

7. Rise in temperature in steam colliers, due to the introduction of triple expansion engines and high pressure boilers. The increase in stokehole temperature due to this is from 5° to 10° F., and this affects the temperature of the adjacent parts of the vessel.

The same factors which tend to give rise to spontaneous ignition in coal cargoes will also be found to be the chief causes of ignition in large masses of coal ashore; and the most prolific source of fire in big stores of coal at gas works, etc., is to be found in ventilating shafts improperly applied, breaking up of the coal, or in some accidental rise in initial temperature, such as a steam pipe or a boiler in contact with a wall against which the coal is stored. In the case of coal bunkers in modern steamers and war ships, the conditions under which the coal is placed are so totally different from those existing in a collier, that no comparison can be drawn between them. In the bunker the question of mass, which plays so important a part in a hold laden with coal, is almost entirely eliminated, as from 50 to 400 tons would be about the capacity of any ordinary bunker; and it has been before shown that the cases of spontaneous ignition in masses of coal of less than 500 tons do not amount to more than one-quarter per cent., and the question of initial temperature becomes the most important factor. A few years ago, such an event as a coal bunker on fire was rare; whereas at the present time hardly a week passes without some more or less serious cases occurring on the fast liners. It is evident that there must exist some well-defined cause for this enormous increase in cases of spontaneous ignition. On collecting evidence on this point, the first thing that strikes one is that bunker fires are almost entirely confined to vessels in which the bunker bulkheads are only separated from the funnel by a narrow air space, or are in close proximity to the boilers themselves; but where the bunkers are "stepped" back from the funnel casing and boilers, spontaneous ignition is a great rarity. Taking the case of a fast liner, it is found that the temperature in a coal bunker varies very considerably, according to its proximity to the air channel round the funnel casing. Close to the outside of the bulkhead, the temperature is often as high as 200° F. (93° C.); while inside, 120° F. would be a fair estimate, and from the center of the bunker to the side of the vessel it is seldom above 75° F. (24° C.). The temperature, however, is higher nearer the iron decks, which, being in contact with the heated bulkhead, conduct the heat through the coal, and often raise the temperature to 100° F.

It has been pointed out that if coal is kept at a high temperature, even though it may be far below its igniting point, ignition is only a question of time; and if the bunker coal next the bulkhead is kept at 120° F., any coal with a tendency to absorb oxygen will run a great chance of igniting within a few days. It is manifest that if this is the real cause of ignition, the seat of the fire ought to be discovered close to the heated bulkhead. But this is very often not the case; the mass of fire being found near the center of the bunker, and sometimes even towards the side of the vessel. Careful examination, however, soon reveals the cause of this, as a line of charred coal is mostly to be found running from the heated bulkhead to the seat of active combustion—showing that the fire started by the high initial temperature has not had sufficient air near the bulkhead to do more than smolder; but that as soon as it came in contact with a current of air passing up through the coal from the hatches in the decks, the smoldering mass began to burn fiercely.

The tendency to spontaneous ignition in coal has always been supposed to increase with the quantity of pyrites present in it; but experiment shows that it is the tendency or power of the coal to absorb oxygen which must be taken as the true index of danger. This may be roughly gauged by the quantity of moisture the coal has absorbed from the air, as, if much moisture is found in an air-dried sample of coal, it at once stamps it as a highly absorbent kind, which must on that account be stored with special precautions; whereas if but little moisture is present it is probably unable to take up enough oxygen to lead to serious mischief. This is very beautifully shown in a table compiled, I believe, by Dr. Percy; and it also makes it clear how little the pyrites have to do with ignition:

Liability to Spontaneous Combustion.	Pyrites, Per Cent.	Moisture, Per Cent.
Very slight	1.13	2.54
	1.01 to 3.04	2.75
	1.51	3.90
Medium	1.20	4.50
	1.08	4.55
	1.15	4.75
Great	1.12	4.85
	0.83	5.30
	0.84	5.52
	1.00	9.01

When once a coal has taken up oxygen, and the early stages of heating are passed, and the temperature has again fallen, all danger of ignition is over; and it may be stored in any quantity with perfect safety. So that if it were practical to keep newly-won coal for a month in moderate sized heaps, and then to avoid much breakage in afterwards loading it, spontaneous ignition would be almost unknown.

The Lauffen Frankfort Power Transmisson.

By Mr. Gisbert Kapp, in the *Electrician*.

The distance between the generating station at Lauffen and the receiving stations in the Frankfort electrical exhibition is 175 kilometres, or about 110 miles. Power was transmitted over this distance for the first time on August 25th, when the current was supplied to about 900 16-candle power lamps in the exhibition, and a few days later the output was increased to 1,100 lamps. There are in the exhibition two receiving stations, side by side, one for the production of power and the other for the production of light, both being connected in such a way that either power or light, or both together, may be obtained at will. The generator at Lauffen is a Brown "three-phaser," made and supplied by the Oerlikon works, and the line consists of three hard-drawn copper wires of 160 mills diameter, supported on oil insulators fixed to wooden poles 26 feet high. There have been erected in all about 3,000 poles at an average distance of 200 feet and the total weight of copper in the line is 60 tons. At Lauffen there are three transformers. One of these has been made by the Oerlikon works, and the two others by the Berlin electricity works. At Frankfort there are also three transformers, two made by the Berlin and one by the Oerlikon works. The transforming ratio of all the six transformers is 1-160, and they are oil insulated. In the power station at Frankfort, which was fitted up by the Berlin works, the current is used for working a 100 horse power three-phase motor, designed by Her von Dolivo-Dobrowolsky. The motor is coupled directly to a centrifugal pump, which supplies water to an artificial cascade 30 feet high. The lighting station at Frankfort has been fitted up by the Oerlikon works, and the lamps are arranged partly on a large signboard of ornamental design in the exhibition grounds, and partly on lamp boards in the exhibition buildings, which serve for varying the load within certain limits.

Mr. Brown's generator at Lauffen is separately excited, and a rheostat is provided, so that the attendant can compensate the loss of pressure in the lime by adjusting the excitation. The common junction of the three armature windings is connected to earth, and the excitation of the field is so adjusted as to obtain from 45 to 60 volts between each branch and earth, according to the amount of power flowing out of the station. The common junction of the low pressure primary circuits in the transformers is solidly connected to the common junction of the armature windings, and by means of a fuse, to the common junction between the secondary or high pressure coils of the transformers. According to the voltage of the three phaser, the pressure between any line wire and earth is from 7,200 to 9,600 volts, and the pressure between any two line wires from 12,000 to 16,600 volts, being $2 \times \sin 60$ of that in each branch.

The general arrangement of the circuits from the generating station at Lauffen up to the branches which lead to the power and lighting stations in the exhibition may best be described by the diagram Fig. 1, in which *G* represents the generator or "three-phaser," the three sets of coils being diagrammatically indicated by the three thick lines *O I*, *O II* and *O III* forming angles of 120° with each other. The primary or low pressure coils of the transformer *T*, are similarly represented by thick lines, and the three dotted lines *o* 1, *o* 2, *o* 3 represent the high pressure or secondary coils of the transformer. The generator coil *O I* is connected with the transformer coil *o*, first by the earth wire *O O*, as already mentioned, and also by an insulated circuit which contains an alternate current ampere meter A_1, a relay magnet R_1, and a fuse *F*. The other two sets of coils on the three phaser and transformer, respectively, are similarly connected. The voltage in three branches is indicated by the three volt meters V_1, V_2, V_3. The relay magnets are arranged for minimum and maximum current, and if the current in any of the three branches of the three phaser should fall short of the minimum, or pass beyond the maximum value for which the relays are set, the relay in that branch cuts off the exciting current from the field of the three

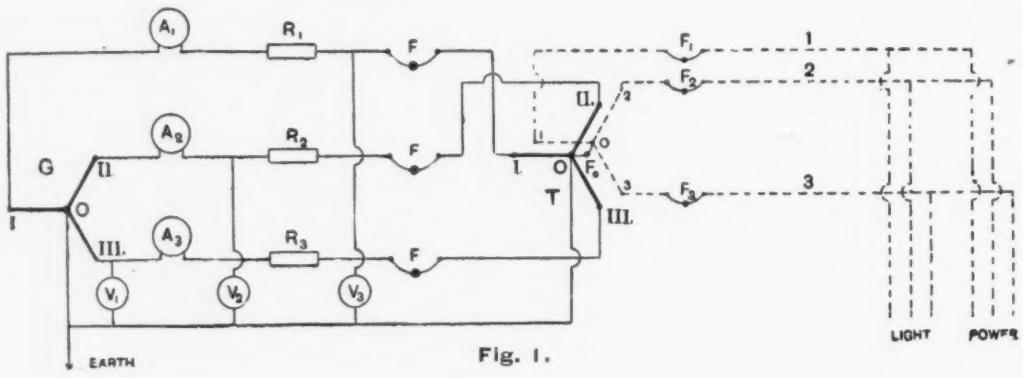


Fig. 1.

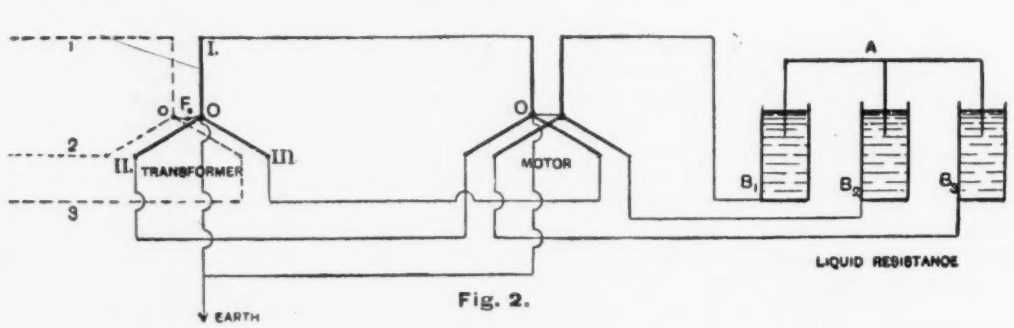


Fig. 2.

The fuses, relays, ampere meters, and voltmeters belonging to the low pressure or primary circuit at Lauffen are mounted upon one board, which also contains the voltmeter and ampere meter for the exciting circuit, and the rheostats for the latter, by which the voltage of the three phaser is adjusted. In order to compensate for the ohmic resistance of the line, the attendant works by a table giving the primary voltage corresponding to various currents, so as to keep the pressure at Frankfort constant at varying loads.

It will be seen that the arrangements of switchboard and instruments at the generating station are of the simplest possible character. In the high pressure or secondary circuit there are no switches, but merely three fuses, F_1 F_2 F_3, as shown in the diagram. To make a fuse for 10,000 volts is not an easy problem, but it has been solved by Ferranti

and others, and any of the existing forms of fuses might have been accepted for Lauffen. Since it is, however, the intention of the two firms who have carried out this transmission plant to work later on at double the present pressure (by using two transformers at each end with the thick wire coils in parallel and their thin wire coils in series) it was thought safest to arrange the fuses in such a way that there can be absolutely no doubt as to their satisfactory working even at 20,000 or 30,000 volts. The method of mounting fuses on a board inside the station, has, therefore, been abandoned, and the fuses have been placed outside, where they form part of the line. As already mentioned, the line wires are 160 mils in diameter. Close to the generating station there is a short piece of line in which each of these circuits consists of a pair of copper wires of only six mils diameter, and about 8 feet in length. There are two posts placed that distance apart to which the line wires are shackled, and the fuse wires serve to bridge the space between the posts. To facilitate the renewal of the fuses the posts are provided with steps. This provision is necessary because the line is at Frankfort frequently short-circuited on purpose to advise the man in charge at Lauffen that he may shut down. For this purpose there is suspended over the three line wires at the exhibition an angular stirrup or bridge of iron, which can be lowered by a cord so as to make metallic contact between the three wires. The fuses at Lauffen are thereby melted, and the man in charge stops the machinery. Telephones are then switched on at both ends, and the line wires are used to speak between the two termini. As long as the stirrup is on the wires in the exhibition, it is perfectly safe to use the telephone, even if by some mistake the machinery at Lauffen were started while a person is at the telephone. The only effect in this case would be to immediately melt the fuses again, and as their replacement gives some additional trouble to the man in charge, he will in his own interest take care not to start the machinery before the appointed time.

It remains yet to describe the provision made to guard against accidental injury to life or property in case one of the line wires should break and fall to the ground, or an earth should occur on the line through some other cause. As will be seen from the diagram the common junction O of the thick wire coils of the transformer at Lauffen is joined by means of a fuse F_0 with the common junction O of the thin wire coils. The electrical center of the whole system is, therefore, permanently connected to earth. Suppose now that the line wire 1 should break at any point between Lauffen and Frankfort and fall to the ground, the broken end will make earth, and the corresponding fuse F_1 in the line at Lauffen will go. Possibly the junction fuse F_0 will go. The line 1 is thus cut out. In all probability the fuse in the low pressure circuit I will also melt; but should this not be the case, the current in this branch will be very much reduced, and set the relay R_1 in action, whereby, as already explained, the excitation is cut off, and the dangerous pressure is immediately taken off all the three line wires.

We have yet to describe the general arrangement of the circuits in the power station at Frankfort, Fig. 2. The primary and secondary of the transformers (of which only one is shown, the other being a spare transformer at present) are again earthed at their electrical center, and the same remark holds good for the field and armature of the motor. The latter is shown diagrammatically in the same way as if it were a transformer, though this representation is not quite correct. The armature and field coils do, of course, remain in the same relative positions to each other, but for the sake of simplicity the diagram may be accepted as sufficient for our purpose. In reality, the field revolves with a greater speed than the armature, the difference in speed or magnetic slip producing the electromotive force in the armature. Now, the torque of the motor is proportional to the strength of the armature current, which latter increases with the electromotive force, and, therefore, with the magnetic slip. If the magnetic slip were zero, that is, if the armature revolved with the same speed as the field, there would be no electromotive force in the armature coils, and, therefore, no current and no torque. A motor of this class can, therefore, not run synchronously, but must run the slower the more the load is increased. The variation in speed between full load and no load can, however, be made as small as desired by the simple expedient of using an armature of low resistance, so that even a slip of 5 per cent. or 10 per cent. shall produce the maximum current required at maximum load. In this respect the 3-phase motor is identical with an ordinary continuous current motor with constant field, since also in this case the speed of the armature decreases as the load increases. To obtain more or less uniformity of speed is, therefore, simply a question of the amount of iron and copper which the designer chooses to employ for a given output; but it should be remarked that by increasing the section of the armature conductors so as to get very little magnetic slip, there is danger of producing a machine which will not readily start at full load. The reason is obvious. A very low armature resistance means an enormous armature current at the moment of starting, when the magnetic slip is 100 per cent. Now, this enormous armature current reacts very strongly on the revolving field, which is, so to speak, blown aside by the ampere turns in the armature. This may, at first sight, seem a very serious drawback to the 3-phase motor, but Herr von Dobrowolsky has hit upon a very simple and ingenious remedy. Instead of short-circuiting the armature coils at starting, he inserts into each of the three branches a liquid resistance, consisting of an iron vessel filled with an alkaline solution, into which an iron plate can be dipped to a greater or lesser depth. The three vessels, B_1 B_2 B_3, are insulated from each other, but the three iron plates are joined by a metallic bridge A. At starting, the plates are immersed only slightly, and the resistance which is thereby interposed in each of the three armature circuits prevents the creation of abnormally strong armature currents, which would otherwise blow the field aside. As the motor gathers speed the plates are more and more lowered, until the whole of the liquid resistance is short-circuited, and the motor works without external waste of energy. As regards the question of efficiency, no definite data are as yet available, since the commission has not yet begun to make its measurements. If we may judge from the absence of heating, vibration, noise and the general sweetness of the running of this motor, there is every reason to hope that the efficiency will be as high as with a direct current motor of the same size. A rough test, which the writer was permitted to make on a 3-phase motor of 2-H.P. gave an efficiency of 82 per cent.

Mine Ventilation.

A contemporary remarks that among the managers of the various companies and individual operators of the Anthracite regions there is being displayed great interest in every innovation, scientific or otherwise, which gives fair promise of adding to the efficiency of their collieries, reducing the liability to accidents which result in the destruction of valuable interests and harrowing fatalities among the employees, or in fact anything which increases the percentage of output of a colliery and correspondingly decreases the waste of this grandest of all fuels.

One of the departments of mining now receiving much attention is that of ventilation, and the greatest and most celebrated minds are engaged in devising means to improve the system now in vogue, careful data being secured and observations taken of the characteristics of underground workings of the various regions. The deep veins are now receiving attention from the producers, and as the subterranean workings become more extensive the matter of ventilation requires more careful consideration. The sections which generate large volumes of gas are viewed with much solicitude as the openings go deeper and the more skillful and thorough men are pressed into service to combat this destructive element. The repeated occurrence of explosions from unknown causes, or at least where no real apparent cause may be assigned, as well as the frequent encounters had with gas in mines that are considered almost perfectly ventilated, naturally directs the thoughts of the managers to the matter of improved methods of ventilation.

The mining engineers of the country seem to appreciate the importance of more effectual service in this department of mining, and there has been a general interchange of views, discoveries and deductions, which have been of vast service to the profession; some of the eminent and practicable specialists even go as far as to say that ventilation is yet largely problematical as understood and practiced by many mining engineers, and only by repeated experiments and a free interchange of deductions may they arrive at the advanced position all desire to attain. The construction of such a remarkably large number of powerful fans, principally of the Guibal type, during the past two years, and the great care exercised in fitting them up, as well as arranging the airways of the mines, give evidence that the present is an era of remarkable interest in the efficacy of thorough ventilation, which will manifestly result in added enlightenment and much benefit will assuredly accrue.

The gaseous colleries are those which now require much attention and no little anxiety, and then, too, as the workings become more and more extensive the requirements of the mine are such that ordinary precaution and supplies often prove unavailing, while atmospheric conditions may appear at any time and create havoc where the calculations were that provision had been made for every emergency. The wisdom of carefully recording every test made of the service of fans is apparent, and especially at mines which generate large volumes of gas, and the engineers are now laying particular stress upon the reliability of these performances.

There are several collieries of the Lehigh and Wilkes-Barre Coal Company, near Wilkes Barre, Pa., which are very gaseous, and recently thorough tests were made under the direction of Superintendent Elmer

H. Lawall, and the results are surprising, as well as very interesting and satisfactory. The tests at the South Wilkes-Barre No. 5 shaft were made on the Capell fan, which is an English invention and the only one in operation in this country. The Capell is constructed at a new colliery where the air appointments have not yet been completed, as there will be a number of splits when the mine is more thoroughly developed. The Capell fan is entirely unlike any other in use in this country, being constructed wholly of metal and has two sets of blades, an outer and an inner set. The six outside blades curve back nearly to a tangent, while the six blades on the inside are about one-half the width of the outside blades and come up to within about 12 inches of the shaft. The dimensions of the Capell fan are 12 feet and 6 inches in diameter and 12 feet in width, and there are two side openings. The sides beyond the inlets are closed and the fan is encased in a large spiral casing. The air passing in through the two openings is prevented from coming together into one volume by a disc in the center of the fan, which separates the two sides, being in size the full diameter of the fan. The Capell, under the stress of a great emergency at the time of the terrible fire in No. 5 shaft, showed a very high water gauge, and the result was eminently satisfactory at a time when the capabilities were carefully noted. The test was made on August 16, 1891, and occupies the first column of the appended table. The Capell fan is 12 ft. 6 in. in diameter and 12 ft. wide, two side openings, 84 ft. area, driven by a 24 × 36 in. engine belted 3 to 1, at No. 5 shaft. The figures of the second column apply to a test on the fan of Empire shaft No. 2, 24 ft. diameter, 8 ft. wide, one side opening, 113 ft. area, driven by 18 × 36 in. engine, August 23d, 1891. The data of third column applies to Stanton No. 7, 35 ft. diameter, 11 ft. 8 in. wide, one side opening, 17 ft. 6 in. diameter, 20 × 48 in. engine. The air shaft, 124 sq. ft., delivered but 92 per cent. of the air. The fourth column was deducted from the fan at Hollenback No. 2, 35 ft. in diameter, 11 ft. 8 in. wide, one side opening 17 ft. 6 in. diameter, 20 × 48 engine. The table follows :

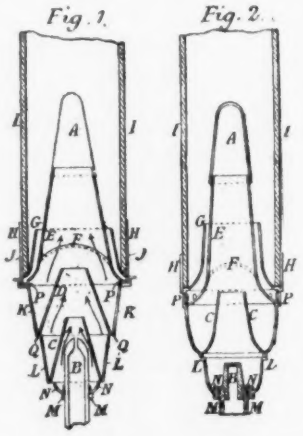
	Capell.	Guibal.	Guibal.	Guibal.
Revolutions per minute	180	74	46	45
Velocity of tips of fan blades	5,865	5,476	5,055	4,945
Velocity of air	1,345	1,370	1,021	1,095
Area of intake	160	141.7	230	221
Quantity of air per minute	1,196	2,624	5,105	5,377
Cubic feet of air per minute	215,200	194,200	234,830	241,995
Water gauge	1.65	2.50	1.85	2.0
Ventilating pressure	8.68	13.00	9.62	10.4
Speed of engine	60	74	46	45
Indicated horse power	123	101	94.6	88.5
Horse power of air current	56	76.5	68.5	76.3
Efficiency of fan	45.3 p.ct.	75.7 p.ct.	72.4 p.ct.	86.2 p.ct.
Cubic feet of air delivered per indicated horse power	1,750	1,923	2,482	2,734

The test at the Empire secured speed of engine at its limit, and the fan at the Stanton is a new one. The action of the Hollenback fan was remarkable when it is known that the casing leaks.

The recorded performances of the English fan present many interesting features, and its work is apparent to one who will examine the facts comprehensively. Compared with the exhaustive tests made of the fans of the Guibal type, the figures are clothed with much more interest, as the Guibal tests were made at the Empire colliery, which is operated on the Red Ash and Ross veins and has a very extensive area of workings. The Stanton colliery, which is admittedly the most gaseous and fiery mine in the Wyoming district, as well as the Hollenback mine, which is quite favorably adapted for the thorough test. All of the fans have received attention and their work was of great interest, owing to the complete test.

Incandescent Gas Burners.

Amongst the English patents recently granted we note one (No. 9,240) that was issued, on the application of A. J. Boult and on the "communication" of J. C. O. Chemin, of Paris, for an improved burner designed to enable ordinary or carbureted gas, water gas, air gas, or natural gas to be employed for heating to incandescence a mantle, cap or dome of wire or other suitable incombustible material, and to utilize the glow or light radiating from such incandescent cap for lighting purposes, while the external shape and arrangement of the burner is the same as that of ordinary gas burners. In reference to his invention the patentee says : "This burner is especially applicable in towns through which gas is conveyed under a pressure approaching that which prevails in Paris ; so that it cannot of itself cause a sufficient quantity of air to be carried away and mixed with it to produce an igniting mixture, capable of generating the maximum temperature which the gas might attain under favorable circumstances. Now, this burner solves the problem of automatically creating a sufficient supply of air for this purpose without any special mechanism but by its own normal operation."



In Fig. 1 (which is a diagrammatic sectional view of the improved burner, enabling the theoretic principle of its operation to be understood), the burner is shown to consist of a vessel or chamber JKL, preferably of porcelain or metal, provided at top with a chimney holder H and its attachments. The vessel or chamber is of any convenient external shape, and is provided throughout its height with a number of orifices of any desired form. Into the lower portion of it, a jet burner B projects, having one or more openings, whereon the vessel may be fastened by a double nut, or by a flange or collar N and a nut M. The burner itself is screwed on to any support—such as a bracket, lamp, chandelier, etc. The vessel or chamber is fitted internally with offsets P Q, upon which rest truncated cones having straight or curved surfaces. The first or lowermost truncated cone C causes the first mixture to form between the gas issuing from the jet B and the air entering through the perforated or open portion L. The second cone D acts upon the initial mixture issuing from the first cone C in the same way as the first cone C acted upon the gas from the jet B; and the mixture takes up more air from the openings of the part K, so that, on leaving the second cone D, the mixture receives another supply of air from orifices of the part J provided for the purpose. This successive admission of air is assisted and increased by the draught created by the glass chimney I.

The crown or ring forming the chimney-holder supports (1) one a truncated cone G, which may be integral therewith, and having either a straight or curved surface, and (2) another truncated cone of the same shape as the cone G, but preferably about double its height, with a small space between the two. The latter may be supported on the chimney holder as in Fig. 1, by means of three or more narrow brackets or fingers, so as to allow of the free circulation of air between the cones G and E; or it can be supported by an offset or shoulder formed on the chimney holder as in Fig. 2. The chimney holder or crown may, for this purpose, be provided with openings around its circumference, as in Fig. 2, so that the external air may enter the space between or about the cones G and E. At the top of the inner cone E, a cap A of metal or other material is adapted to be heated to incandescence. Besides, within the cone E is arranged a dome-shaped wire-gauze screen F, the object of which is to render the mixture of gas and air burning within the cap A uniform and homogeneous, and at the same time to prevent the igniting mixture formed in the manner already explained from coming into contact with the incandescent cap, and, on being ignited thereby, burning within the apparatus. This screen is an essential feature of the apparatus ; and the patentee particularly points out in this connection that, in the arrangement described, the mixture of gas and air always burns upon the outer surface of the cap or dome A, and never within it, which constitutes a striking destinction between the operation of this burner and other incandescent burners.

The space left between the two cones G and E is to admit a current of air between them, so as to prevent their being heated to an excessive degree; while, on the other hand, this current of air also supplies the oxygen necessary for the complete combustion which takes place on the surface of the incandescent dome or cap.

The cones E, D, and C, and the vessel or chamber J K L, may preferably be made of porcelain or metal ; and the cap or hood A, which is to be heated to incandescence, may be made of a suitable metal—such as platinum, palladium, iridium, or the like—or any alloy of such or

other metals, or of magnesia, or other suitable material. The number of cones may vary according to the effect it is desired to obtain; and their surfaces may be straight, as in Fig. 1, or curved as in Fig. 2.

Fig. 2 shows a burner constructed for small supplies of say 100 to 200 litres per hour. The two upper cones *E* and *G* are separated from each other by a series of openings provided in the crown or chimney holder. Against these openings a correspondingly perforated ring P is arranged, capable of a slight turning motion, whereby the amount of air sucked in by the chimney draught between the cones *G* and *E* may be controlled. This control of the draught correspondingly affects the air supply through the opening of the lower chamber or vessel, so that the respective quantities of air may in every part be regulated at will. By surrounding the chamber just mentioned by another external chamber or casing, which may or may not be surmounted by a glass chimney, the apparatus can be rendered suitable for recovering heat, and the burner be fed with heated air.

The Relative Merit and Cost of Gas and Electricity for Lighting Purposes.

Mr. W. H. Preece, in a lecture delivered by him some time ago before the Incorporated Association of Municipal and County Engineers (England), on this subject, said:

I have the pleasure this morning of bringing before you the subject of the relative merit and cost of gas and electricity for lighting purposes; and, as a practical man speaking to practical men, I propose to consider the matter solely from a practical point of view, and to deal rather with the financial aspect of the question than with mere technics. Of course I shall have to deal with figures, and figures are proverbially dry. It has been said that you cannot extract a joke out of figures, and that you can always manipulate them to suit your own particular views. Neither statement, however, is quite true. As regards manipulating figures to suit one's own ideas, I dare say it will be said I am going to do very much that kind of thing; but I am addressing you to-day—if I have any prejudice—as a gas shareholder, and not as an enthusiastic electrician.

Comparisons of cost are generally fallacious, because the comparison depends so very much upon the point of view. The questions which we have to decide are generally such as this: What is the capital involved in any particular industry? What is the profit derived? What has the consumer to pay? Well, I told you I am going to address you as a practical man; and I am not going to bring before you any fanciful figures. They are figures which you can all get for yourselves, and you will be able to check the deductions I am going to make. Now, I have taken the case of Manchester for the simple reason that I have more authentic records of what is done there than in any other town. From the records of the Gas Department of that city, it seems that a ton of coal produces 9,611 cubic feet of 20-candle gas. Of course, that is rather above the average candle power throughout the country; the average is not more than 15 candles. Since this is the quantity of gas produced by a ton of coal, it follows that 1 lb. of coal will yield 4.29 cubic feet of gas; and if 4.29 feet of Manchester gas is burned per hour, we get an illumination of 17.2 candles.

In drawing a comparison between gas and electricity I must use one technical term. It is a term that has come into very general use, and will have to be understood—even if it is not understood now—by every engineer, whether electrical or municipal. That term is the "watt." A watt is a unit of power. The common unit of work with which we are most acquainted is the foot-pound; and the unit of power we know best is the horse power—that is, the power exerted that will raise 33,000 pounds 1 foot per hour. In other words, you may say a horse power is the power which will raise 550 lbs. 1 ft. per second. Now, a watt is the power which, in the metrical system, will raise—I forget the exact value in grammes per centimeter; but it is that exact power which is exerted by a current of electricity called an ampere when flowing through a resistance of 1 ohm for one second—it connects mechanical power with electrical enery. So, in the use of electrical energy, if we burn in a steam boiler 7 lbs. of coal per hour, we shall get 1¼-horse power. But represented in watts, it means that we shall produce 1,000 watts; and 1,000 watts is called a kilowatt.

We saw that 1 lb. of coal turned into gas will give us an illuminating power of 17.2 candles. I must here observe that we can use electrical energy in two forms—one in the arc lamp which we see illuminating streets a good deal, and the other in the glow lamp, which we use in our houses. Now, 1 lb. of coal burned in a boiler to produce steam will supply electrical energy which will give, if burned in the form of a glow lamp, 48 candles; and if in the form of an arc lamp, 288 candles. So there we start with the first theoretical fact that I wish to bring before you.

But now we will come to hard facts. In Manchester, during the 12 months ending March 30, 1890, the income derived from gas was £434,351; and the expenditure was £360,804—showing a balance of £73,547, which was devoted to meeting interest on loans, depreciation, cost of public lighting, etc. But from that fact I derive this—that the cost of 1,000 cubic feet of gas was 2s.; and, therefore, 2s. produced an illuminating power of 4,000 candles. I am obliged to use an estimate, for the simple reason that the present Corporation of Manchester have not established a central electric lighting station. They have obtained a Provisional Order to enable them to do so; but they are now considering whether they shall carry out the order themselves or transfer their powers to another body. In making an estimate of the cost of producing electricity in Manchester, we have to take the experience of other places; and on this point of cost there are perhaps more reliable, accurate, and truthful facts than on anything else connected with electricity. The Board of Trade exercises such a powerful control over the electric lighting interest that there is no "hanky-pankying" with the accounts. They must show the cost of production; and they are within the reach of everyone. We have at the present time a great many of our post offices lighted by electricity. I have a large central station at the general post office, and have there a plant by which we are going to produce sufficient power to illuminate 10,000 lamps. We are laying down another central station at Coldbath Fields—now called Mount Pleasant—where we shall be able to generate electricity for a further 10,000 lamps.

From my own experience there is not a shadow of doubt that at the present moment we can produce a kilowatt-hour (which is the unit of energy to compare with 1,000 cubic feet) for 4d. Taking this 4d., it means this: That we can produce 4,000 candles by gas for 2s.; by an arc lamp for 8d.; and by a glow lamp for 4s. So that you see on these facts (I will not call them estimates, they are facts) that the theoretical limit of light produced is twice as much by the glow lamp as it is by the gas lamp. These are theoretical limits; they are not practical ones. We all know this, however proud we, as gas engineers, may be at producing gas of 20-candle power, that, when we go to the shops and houses of the consumers of gas, the 20 candles are greatly diminished.

This is a very important question; but it is one that, some six or seven years ago, concerned us very much at the post office. Mr. Vernon Harcourt and I devoted a considerable amount of time to experimenting on this question. Mr. Harcourt found that an ordinary open burner, supposed to consume 5 cubic feet of gas per hour, and which ought to give a light of 15 candles, really only gave practically 10 candles—due to dirt in the burners, and probably to the draughts and the flickering of the light preventing the proper combustion of the gas. This pro rata value found for London is equally true for Manchester or anywhere else; and the result is that, to obtain 4,000 candle power, you must practically add 30 per cent. to the cost of the gas.

By the by, I ought to say that this depreciation of the value of light is not only true in the case of gas, but it is also true to a certain extent in the case of electricity. The lamps that are sold will give you, when they are new, 16 candle power; but in the course of 200 or 300 hours there is a peculiar action progressing between the current of electricity which is flowing and the carbon filament, which causes the latter to evaporate—it flies away in straight lines, and is deposited as a thin coating on the glass bulb, obstructing a certain amount of light. You have also a quantity of dirt accumulating on the exterior of the glass bulb; so that you have a depreciation of the value of the electricity, although not so great as in the case of gas.

I should mention that, in the remarks I am now going to make, I draw no distinction in light-giving power when I speak of a lamp, whether electric or gas. Five cubic feet of gas will give practically 10 candles; 33 watts of electricity in its normal condition will give 10 candles. So, by taking your calculations on 33-watt (or 10-candle power) lamps, you draw a very fair comparison between gas and electricity when used as an artificial illuminant. These figures want further correction. There is one element in gas which is a very serious loss indeed—that is, the tremendous waste of gas which occurs through lights being left burning unnecessarily. The result is that quite 20 per cent. of gas is used more than is essential; and it is brought out as a very striking fact by this—that, taking the nine principal towns in this country, the average number of hours of burning gas is 600; while the average number of hours for electricity is 460. This last figure is taken from 200,000 lamps which are now alight in London. Well, with gas you have a tremendous waste, owing to these burners being left flaring about; but with electricity we have no such waste. By simply turning a tap we can put the light "in" or "out;" while with gas you each

time require a match. There is a species of instinct that teaches the consumer at once that, if he wants a light in a particular place, with electricity he has only to turn the tap; and when he has done with it he has simply to give it another turn. The result is he gets no waste.

Now, it comes to this, that the comparison between gas and a glow lamp is not 2s., but the practical figure of 3s. 8d. Now we can prove this. The average amount paid in the nine chief towns of this country per gas burner is 9s., while the average price of gas is 3s. per 1,000 cubic feet. The average price of the 200,000 lamps that are lighted in London is 10s. per lamp. So that we have these two facts—that the average price paid by the consumer of gas is 9s. per annum, and by the consumer of electricity, 10s. This is a startling figure, because most people are under the impression that the cost of the electric light is very much greater than gas; and I have been myself much surprised to find that the price paid in my house (where I generate my own electricity, and have done so for seven or eight years) was so very small. I have a gas engine, accumulators, and over 70 lamps fixed in the house; and I am paying no more than I did for gas lighting,—the price per lamp being less than 10s.

I have taken all the electric light companies in London, and have tabulated the revenue derived by each company per lamp per annum,—that is, a 33-watt lamp. The Metropolitan Electric Supply Company derived a revenue of 12s. per lamp; the Chelsea Electricity Supply Company, 8s. 6d.; the Kensington and Knightsbridge Company, 9s. 2d.; the House-to-House Electric Supply Company, 11s. 6d.; the St. James and Pall Mall Electricity Supply Company, 9s. 6d.; and a Company not in London—that is the Brighton,—8s. 6d. The average amount paid for 200,000 lamps, is, therefore, 10s., compared with 9s. for gas. Well, I have verified this ratio between the two. Taking two year's experience with each light at the General Post Office, we find that gas costs us 18s. per lamp, and electricity 22s.; the ratio being 9 to 11, and not 9 to 10 as in the figures I have given you. Taking Manchester, where the gas is cheaper than in London, it appears from the returns that the average price paid per lamp for gas is 7s. 6d. per annum; while, taking the cost of the production of electricity,—viz., 4d.,—the revenue that Manchester will derive from electric lamps will be 8s. 4d. The rates of charge for electricity vary very much. In London the private companies are charging in some instances 7½d., and in others 8d. In Bradford they commenced by charging 5d.; and they have raised it to 6d. In Newcastle they charge 4½d., and allow large discounts. At the Post Office in Newcastle we have large users of electricity; and I think we have a discount off the 4½d., which makes the cost approach very closely to that of gas. In the case of factories, where they have installations, electricity is really cheaper than gas. I have the figures from a large mill at Bolton, where they have had the electric light in use for upwards of six years. While they were using gas, the cost per lamp came to 5s. 6¼d.; since generating their own electricity, it works out to 4s. 0¼d., which is a considerable reduction. Those who are acquainted with Manchester know that under the Exchange there is a large restaurant that used to be unbearable when it was lighted with gas. The manager, however, replaced the gas with electricity; and he finds that he not only saves 800*l.* a year in the cost of illumination, but he has probably doubled the business by clearing the atmosphere and enabling his customers to have their meals in comfort.

So far as figures go, I think that I have given you rather hard facts to show that there is not much difference between the cost of electricity and gas. In my own case I burn gas; but I do so in the garden, and extract from it that which I want—viz., light for my house. Take 25 cubic feet of gas and burn it direct, you will practically get only 50 candles by means of the burners, from which I have drawn my calculations; but if you burn 25 cubic feet of gas in a gas engine, and get horse power, and convert it into electrical energy, this will give you 160 candles. Therefore with a little additional expenditure and care you are able to use gas and get treble the light-giving power in your house. I ought to have mentioned before that one of the great merits of electrical machinery over gas plant is the small space that the former requires. In the case of gas plant, 100 ft. by 50 ft. is, I believe, needed for every million cubic feet of gas produced per annum; but a similar space is quite sufficient to light up the whole of one of our big towns by means of electricity.

We must not neglect other points. When we adopt electric lighting we remove from our midst a source of deterioration of our goods and chattels, and books and pictures, and that which dirties our ceilings: we are introducing something that encourages cleanliness; and we add materially to our comfort, and consequently to our cheerfulness. As to the security of our buildings, electric lighting is not absolutely safe. It is all nonsense to say that it is perfectly safe; it is not so. Carelessness will cause fire as in the case of gas. It requires the usual care which engineers know so well how to exercise. The question of health, however, I want to thrust down everybody's throat. We find in the savings bank department at the general post office that the cost of the electric light is paid for by the increased service we get out of our staff. The introduction of the electric light there has diminished the number of hours of absence by two hours per head per annum. This diminution, put down at 10d. per hour (which is the ordinary rate of pay for overtime in the Government service), saves us £680 per year alone. The electric light costs us £700, so that really the cost of lighting is only £20 a year. I succeeded in putting the electric light into the general post office just before last Christmas, and the Controller told me that the light on Christmas evening enabled them to get through their work quicker than in the previous year to an extent equal to 200 men. The sanitary aspect of electric lighting is also of great importance to engineers. The impurities emitted by gas into the air are poisonous, and gas burned in a bed chamber is as great an evil as bad water and bad smells.

There is another point connected with electric lighting—it is not a luxury. A common statement made, when matters of this kind are argued by local boards and other authorities, is: "This is a light of luxury. We don't want this thing in our midst; it is only the rich man who can afford to pay for it." The electric light, I contend, is the poor man's light. If you can give a poor man a light for 8s. 4d. a year, as in Manchester, think of the benefits he will derive, living as he does in a close, ill-ventilated chamber, where gas and oil are really filthy. Besides, the price of gas is going up through strikes, labor disputes, and so on, while the price of electricity is coming down. We can produce 1,000 cubic feet of gas at 1s. 10d. (that is, taking 2d. off for collection and management), or perhaps as low as 1s. 7½d., 1s. 4d., or even 1s. But what can we produce electricity for? I have just been making an exhaustive inquiry as to the cost of electricity for the production of phosphorus and the decomposition of copper. These are industries where the use of the current is continuous, whereas in electric lighting the load is irregular. Where the load line is regular, as in works where phosphorus and copper are manufactured, you can produce electricity for ½d. per unit. It means this, that if we take the theoretical difference between gas and electricity, the equivalent of gas is produced at 3d.; so that we have the prospect before us of producing electricity at ½d. per unit, against 3d. for gas. There is one reason why gas is still ahead of electricity. It is that there is such a market in this country for residuals. The price obtained for coke, ammoniacal liquor and other products, practically reduces the price of coal to the gas manufacturer to something like 4s. per ton. In London we have to pay for Welsh coal about 23s. per ton; and that is why in London electricity must cost more than gas for some time to come. I have been looking into the matter of the lighting of Malta and Gibraltar; and when we come to those places, where there is no market for residuals, there is no difficulty whatever on my part in showing that it is possible to produce electricity cheaper than gas.

I have now done, gentlemen. As I said at the beginning, I wish to place this matter before you as a practical man speaking to practical men; and I want you, if you agree with my calculations, to point out to your different authorities that their duty is to look to this matter of the introduction of the electric light—not only from a financial point of view, but from a political, as well as from a sanitary point of view—and try to persuade them that the electric light is not the light of luxury, but the poor man's light.

A brief discussion followed the lecture. The President first moved a vote of thanks, which was seconded by Mr. Lemon, of Southampton. Mr. Brodie, of Whitehaven, asked whether Mr. Preece, in comparing the cost of the two lights in his house, included the outlay for the gas engine, dynamo, and other plant. He also drew attention to the fact that Mr. Preece had taken the price of electricity at Newcastle for his comparisons; and there it was only 4½d. per unit, with a large discount. This was an unfortunate instance to take, as coal should certainly be cheaper there than anywhere else. What he should like to know was, what would be the cost per unit at Malta and Gibraltar, where the cost of coal was greater. Mr. Fowler, of Stockport, observed that the remarks Mr. Preece had made as to the use of gas engines for generating electricity were based on the use of ordinary coal gas. If Dowson gas were used he apprehended the cost would be reduced to something like one-third, because this gas only cost 2d. or 2½d. per 1,000 cubic feet.

Replying to the points raised by the various speakers, Mr. Preece said first with respect to the relative cost of gas and electricity in his house, he would cry "peccavi." He was now using exactly the same quantity of gas in the engine as he did previously for lighting direct with gas; but by means of the engine he obtained three times the amount of light. It was now the first time the question had been put to him. "You, a

business man, allow nothing for depreciation, nor for interest on capital?" He replied, "Certainly not. You do not allow for depreciation on your piano, or interest on the money paid for your pictures or furniture. Then why should I allow interest on the outlay for my engine and dynamo?" As to the cost of coal in Malta and Gibraltar, he might say that the element of coal was not a serious item in the cost of the production of the electric light. The cost of coal per unit in London was about 1d.; but, as a matter of fact, the cost at the general post office was ½d., and that with best Welsh steam coal at 23s. per ton. Coal could be had at Malta and Gibralter at 24s. and 25s. per ton; so that really there was no perceptible difference. There was no doubt whatever they could produce electrical energy by means of Dowson gas in gas engines at one-third the price of illuminating gas. The most careful experiments had been made by Messrs. Crossley, and they stated that by Dowson gas it cost 1¼d. for fuel per horse power per hour. The ordinary price allowed for coal was 2½d. per horse power.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

AT the annual meeting of the Birmingham (Ala.) Gas Company the reports presented repecting the operations of the Company for the year were very satisfactory. The officers chosen were: President, B. F. Roden; Vice-President, Joseph F. Johnston; Secretary and Treasurer, F. L. Bivings; Superintendent, T. Byron.

WE are in receipt of a copy of the "Announcement and Programme of Lectures, 1891–92" of the Franklin Institute, which as usual puts out a rare treat for its members. The lecture course opens on November 2d, and closes on February 29th, and in that interval no less than 32 well varied themes will be lectured upon by speakers, the majority of whom have international reputations. Prof. Edward Orton, Director of the Ohio Geological Survey, will bring the series to a close, by a lecture (February 29, 1892) on "Petroleum: Its Geological History and Use in Modern Civilization." It might be remarked that, in respect to "non-resident members," the laws of the Institute read: "Newly-elected members residing permanently at a distance of 50 miles or more from Philadelphia may be enrolled as non-resident members, and are required to pay an entrance fee of $5, and $2 annually."

SOME time ago the customers of the Columbus Gas (natural) Light and Fuel Company, of Sharon, Pa., presented a petition to the Company asking that a reduction in the selling rates be made. The Company, after due consideration of the petition, returned the following answer: "The natural gas business was always considered a hazardous one, but not until within the last year anticipated that the risk in the failure of gas was so great as it has proved to be in the last 12 months. All the Pittsburgh companies have carried on the business as though it would last always, until the last year, when they found themselves very short of gas, with large indebtedness hanging over their heads, caused by having to purchase gas territory and increase the size of their lines; and also found their stock not worth on the market more than one-quarter to one-eight of what it cost them, and they have been so far unable to improve this condition of things. While the Columbia Company's condition is not so bad as the Pittsburgh companies we have spoken of, yet, in a great measure, this is true of the Columbia Company. The pressure of the gas wells from which the Columbia began to take its supply was at that time 640 lbs. The pressure now at those wells is not over 120 lbs., and perfectly useless for the Columbia Company to carry gas a distance it has to be carried to reach Sharon. But for the large expenditure that the Columbia Company has gone to in hunting for new territory and acquiring it, at a distance of from 7 to 15 miles from its original wells, Sharon would not have any gas to speak of to-day. In fact the gas rates at Sharon are really at a lower figure than the Company should, in justice to its proprietors, charge."

IN our issue of a fortnight ago we noted that Mr. C. R. Dinsmore had resigned from the Superintendency of the Marblehead (Mass.) Gas and Electric Light Company, and we are now called upon to chronicle the lamentable fact that his death occurred some days after the resignation was handed in. His resignation was to have taken effect on Thursday of last week.

AN appeal has been filed with the Massachusetts Supreme Court for the dissolution of the Middleboro Electric Light and Power Company.

ON Thursday of last week, Messrs. H. S. McKee, R. C. McLean, J. D. McCable, J. G. Ormsbee and Wm. R. Hartupee, applied to Governor Pattison for the right to erect and operate gas plants at Homestead, McKee's Rocks, Chartiers, Esplen and Mansfield, Pa. The Company is capitalized in $250,000, and the purpose is to enrich the natural gas, by a certain patented process, so that it can be used for fuel and lighting, the supply to be carried on at a much higher figure than that at which the natural gas is now furnished. Every indication in the Pennsylvania natural gas district is that the woeful waste of the past four years has brought about the inevitable result.

"OBSERVER" forwards the following, from a Providence paper, regarding the proposition to install a municipal electric lighting plant at Fall River, Mass.: "The committee that was asked to consider the advisability of establishing an electric light plant for city purposes reported as taxpayers generally expected it would report. As the books now balance, it is a little difficult to understand how the town would manage to buy an electric light plant, if said plants were selling at $1.25 each, instead of $200,000. It has already been explained that, owing to an increase in the tax rates and the amount of assessed property, money is a trifle scarcer this year than it ever was before, and it was necessary to practice the closest economy with the license funds in order to make both ends meet. The same financial condition of affairs will prevail next year, and for the next 500 years, so that there will never be any great danger of crowding private capital out of the field here."

THE Citizens Gas Light Company, of Willimantic, Conn., expects to occupy its new premises on or before November 15th.

THE electric lighting service at Chattanooga, Tenn., is so bad that the people are disgusted with it. Perhaps the proprietors will see their way clear to putting more money into the concern, although their investment now would appear to be sufficiently heavy.

IN connection with the Hebraic crusade (and when the Harlem Hebrews turn their thoughts to cleanliness with greater pertinacity than has hitherto been their wont, it will be all the better for the general health of that portion of New York) against the Standard Gas Company, which crusade is being carried on before the Health Board, the following mention will be of interest. "Exhibit I." is a statement from the Harlem *Local Reporter*, of the 10th inst., and "Exhibit II." is a correction of the statement, furnished by the "Engineers" spoken of in the *Local Reporter*.

"*Exhibit I.*—The Health Board received a letter on Wednesday (Oct. 7), from the Directors of the Standard Gas Light Company stating that Prof. Charles F. Chandler had been engaged by them to make an examination of the gas works at the foot of East 115th street and ascertain the improvements required to do away with the unpleasant odors. The Board in executive session reaffirmed its former decision, which declares the gas works to be a nuisance and ordered the works closed until the Board shall be convinced that the nuisance is abated. The Sanitary Superintendent was ordered to make an examination and report at the next meeting of the Board the length of time that would be required to execute the order and also report any disobedience of the order. In accordance with the order of the Board of Health, which was given on Tuesday afternoon, very little is going on in the works of the Company. With the cessation of the works there was an end of the smell, and the people who have been inconvenienced for such a long time by the foul odors were enabled to breathe pure air. There was general rejoicing, and one enthusiastic gentlemen said that the undertaker who had been getting rich by the number of funerals in the neighborhood brought about by the smells would not make so much money, and that he looks for a return of the good old days when the section which the gas works invaded was picturesque and aristocratic. President Andrews of the Gas Company was not so happy over the result of the fight as was Mr. Rosenheimer. He characterized the whole business as a piece of persecution and said that he would have the water tested by an expert analyst in a day or two in order that a sample and the report upon it may be sent to the Board of Health. When asked why he had not had a sample of the water analyzed before the works were stopped, he replied that the question was impertinent and refused to say any more about the matter. The Engineer in charge of the works said that he is working on several systems of flues by which the oil may be burned and the odors abated, which he will in a day or two submit to the Department of Health, with a request to be allowed to resume operations."

"*Exhibit II.*—This whole story shows how much truth there is and how much reliance may be placed in very many of the newspaper reports. It is a fact that the works of the Standard Gas Light Company have not been stopped, have not been shut down, and have not ceased

to make gas for one consecutive minute, since the said "Engineer" took charge of the same, in June last. He has never been nor did he claim to be engaged in devising a 'flue for burning oil,' nor has he any idea of asking for permission to resume operations, because these have never ceased. In a word, the whole statement is simply a contemptible lie.—FREDERIC EGNER."

GENERAL FREDERICK E. CAMP, Secretary, Treasurer, and Purchasing Agent of the Middletown (Conn.) Gas Light Company, died at his home in that city, on the 8th inst., after a long illness. Deceased, who was well along in years, served during the war in the 24th and 29th Connecticut regiments, and after the rebellion ended acted as a Captain in the regular army, a position that he held for ten years. In 1881–82 he was on the staff of Governor Bigelow as Paymaster General of the State militia, and was State Adjutant General under Governor Lounsbury in 1887-88. He was prominent in local affairs, and was well liked by his fellow-townsmen.

The offices of the Citizens Gas Light Company, of Wakefield and Reading, Mass., have been removed from the Woodward Building, on Albion street, to the Company's works, on Railroad street. Mr. Louis R. Wallis, formerly Agent in New England for the Buckeye Electric Company, of Cleveland, Ohio, has been appointed bookkeeper for the Gas Company.

THE Franklin (N. H.) Gas and Electric Light Company has placed a contract with the Edison Company for the installation of a 45-light arc plant, of the Edison type. This move is taken in order to enable the Company to carry out the public lighting contract recently awarded it, under the terms of which the town agrees to take 33 arc lights, to be kept alight until midnight of each night in the year, on the payment of $65 per light per annum. The contract is to run for five years.

THE Belfast (Me.) Illuminating Company is now in possession of the franchises and plants of the local gas and electric lighting companies. The terms of the consolidation were previously given in the JOURNAL.

THE Carolina Heat and Gas Company will construct a gas works at Shelby, N. C. The place is the capital of Cleveland county, and is at a point on the first Broad river about 54 miles west of Charlotte. It has a population of possibly 4,200, and is rapidly becoming an important manufacturing center.

AT the stockholder's meeting of the Mansfield (Ohio) Gas Light Company, held at the Company's office in the Wiler House building, the following Directors were elected: Messrs. Joseph H. Hedges, Lyman Strong, Samuel Uhlich, John McIlhenny, Joseph Gardner and S. E. Bird. The Directors organized by electing the following officers: President, Lyman Strong; Vice-President, S. E. Bird; Treasurer, Joseph S. Hedges; Secretary, Will C. Hedges; Superintendent, George S. Harris. It was determined to put in an additional plant of the water gas type, of a capacity sufficient to double the present send-out. At the same time and place the Mansfield Electric Light Company's annual meeting was held, and the Directors chosen were the same as those above mentioned, with the addition of Mr. H. E. Bell. The officers chosen were: President, S. E. Bird; Vice-President, Samuel Uhlich; Treasurer, Joseph S. Hedges; Secretary, Will C. Hedges; Superintendent, George S. Harris. The management will enlarge the generating capacity of the plant, as a guarantee against "breakdowns." Both the Companies are prospering, and the proprietors are more than satisfied over the outlook.

THE New Bedford (Mass.) Gas and Electric Light Company dividend of 1½ per cent. was payable on Thursday last.

THE authorities of Tyrone, Pa., have awarded a contract for the public lighting to the Home Electric Company, at its "revised" bid of $75 per arc per annum, lights to be in duty each night and all night of the year, the contract to remain in force for three years. When the bids were opened it was found that the Tyrone Gas and Water Company's proposition was the lowest, but in order to cause the discrepancy to be less marked the Home Company (whose original bid was $84 per lamp) was permitted to take $9 off per lamp per annum, and the contract was then allowed on the amended basis. The bids as originally submitted were as follows: Tyrone Gas and Water Company $40 per lamp for three years; Home Electric Company, arcs, $84 each per year; incandescents (24-candle power), $21 each per year. Mr. C. H. Dieffenbaugh, Supperintendent of the Tyrone Gas and Water Company, in his note to us on the subject, says, among other things: "Had we wished to do so we could have compelled them (the Council) to give us the contract, but thought it better not to fight. If there is any place in which a company is supplying 45, or less, arc lights, for 365 nights, at the rate of $75 per arc per year, I would like to know what dividends are paid to the shareholders. The local Electric Company supplies commercial arc lights, on an 11 o'clock schedule, at the rate of $72 per year."

THE new holder for the Biddeford (Me.) Gas Light Company, the contract for which was awarded to the Davis & Farnum Manufacturing Company, will be ready in ample time for the coming busy season. The Biddeford Company's sendout is increasing—a notable thing about it being that the consumption per meter more than keeps pace with the increase in new consumers.

AT a stockholders' meeting of the Saratoga (N. Y.) Gas and Electric Light Company the following officers were chosen: Trustees, William Foster, Jr., Elias H. Peters, Charles F. Stone, Alfred W. Trotter, and William Reynolds; President, William Foster, Jr.; Treasurer, William Reynolds; Secretary, Elias H. Peters.

THE New England Weston Illuminating Company has been absorbed by the Boston Electric Light Company.

SOME days ago a fire broke out in a storage shed of the Stamford (Conn.) Gas Light Company, and the flames at one time were threatening enough to place the main buildings in danger. The firemen, however, managed it well enough to confine the fire to the sheds in which it originated. The money damage was trifling, but Assistant Superintendent John A. Waters unfortunately sustained a severe injury to his right arm.

THE Newport (R. I.) Gas Light Company has purchased the property lying between the gas works and Wellington avenue. The plot contained 21,787 square feet, and will be a valuable addition to the Company's real estate holdings.

ACCORDING to local advices, the suit brought by Mrs. James Hurley against the Laclede Gas Company, of St. Louis, Mo., to recover $5,000 damages, has been compromised, complainant having accepted $2,500 in complete satisfaction of her demands. The suit grew out of the accident at the works last May, at which time complainant's husband lost his life, while in the Company's employ, through the falling in of the roof of a retort house at Station A of the Laclede works.

THE Edison Company was awarded the contract for installing an incandescent electric lighting plant at the State Reformatory, St. Cloud, Minn., at its bid of $1,285, lamps to be considered "extra," and to be charged for at the rate of 40 cents each—lighting equivalent of lamp to be 16-candles. Other bids submitted were: $1,785 for plant, lamps to cost 60 cents, and $1,950 for plant, with lamps at 60 cents. The installation is calculated to support 295 lamps.

WE are indebted to Mr. Chester P. Dewey for the following, from a recent issue of a Rochester (N. Y.) newspaper: "July 1st next the contracts of the city of Rochester with the electric light companies will expire, and beyond a doubt the question of a renewal will receive close consideration, as the expense attendant upon the city's illumination by electricity has reached a very high figure. The Lamp Committee (Alds. Adams, Cleveland, Lewis, Shelton and Kelly) of the Common Council will be the investigators. In fact, the chairman of the committee (Ald. Adams), when spoken to on the subject by a reporter, said: 'The city is not by any means dependent on the electric companies. All the gas lamps, it is true, have been removed from Main and state streets, but in other parts of the city it is the policy of the committee to allow the gas lamps and posts to stand. The whole number of posts removed outside the business portion of the city is very small, and so we could, on 24 hours' notice, cause the gas lamps to be lighted.'" The local paper then continues: "The gas lanterns, which all belong to the Gas Company, have been removed by the Company from all 'dead' posts. The city owns the posts (the average cost of the same was $7 each), and many of them have been sold to outside towns, at the rate of $4 each, but that demand has not absorbed all of them, as at present quite a number are stored ready for sale. Another question that may be raised is whether or not electric lighting is to be introduced exclusively in the city. Five years ago (April, 1886) there were in use 1,982 gas lamps, 1,332 oil lamps, and 309 electric lights. At present there are no oil lamps. According to the July budget there were 804 gas lamps, 1,083 arc, and 790 incandescent electric lights employed, and it is notable that when arc lights were first introduced each arc displaced 5 gas lamps, but as the arc circle of illumination was carried to districts not so populous as those that witnessed its introduction, the ratio of dis-

placement has decreased, until now it might be claimed that on the grand average one arc displaces but 3.8 gas lamps. For residence streets some people prefer gas. For instance, the Upton Park residents protested against the introduction of electric lights on that street a few weeks ago, when a resolution for such action was pending in the Common Council, and gas was retained. On Meigs street several citizens were displeased with the introduction of electricity, and hold that gas was preferable. According to their view it is too bright near the lamps and too dark in the shadows, and they also consider the poles and wires unsightly. Near one residence a shade was put on the lamp to prevent too brilliant an illumination of the house. It is to be noted that quite commonly electric lights are ordered for a street without a petition of the property owners, this being a formality the observance of which is not obligatory. The cost of lighting the city has grown in the last five years, as follows: For the year ending April 1, 1886, the cost was $93,949.28; for the year ending April 1, 1891, it was $146,694.33. One arc light costs 28½ cents per night and a gas lamp costs 5 cents a night."

If these figures are correct it would seem that Rochester could be lighted much cheaper by gas than by electricity. For instance, presuming that the lighting value of 3.8 gas lamps is equal to that of one arc light, it is seen that an improved gas service under the conditions mentioned would be 19 cents per light per night as against 28½ cents for electricity.

In connection with this it should be remembered that the Rochester electric lighting companies are enabled to furnish 2,000-candle arcs, on an all night and every night table at 28½ cents each per night, because of an abundant and never-failing complement of water power.

A most noteworthy feature of the annual reunion of the Society of the Army of the Tennessee, held in Chicago something less than a fortnight ago, was the elegant eulogy to the late General Sherman that was spoken by the Secretary of the Society—General Andrew Hickenlooper. It was a tribute glowing with sincerity and does infinite credit to the head and heart of the man who pronounced it.

At a special town meeting, Spencer, Mass., at which was considered the proposed purchase by the authorities of the plant of the Spencer Gas Light Company, a ballot was taken that resulted in a decided negative.

Some time ago we noted that the proprietors of the Pulaski Gas Light Company, of Little Rock, Ark., had applied to the authorities for an extension of their franchise, which will soon lapse through limitation. The City Council, after much cogitation, has signified its willingness to extend the franchise, under conditions somewhat more restricted than those originally petitioned for by the Company. It is likely, however, that the petitioners will accept the franchise, under the belief that better terms cannot be obtained. The notable features in the agreement are: The franchise is to run for 30 years; the Company shall pay into the city treasury, on the 2d of January of each year, 2 per cent. of its net earnings, the sum to be determined by sworn statement of its Treasurer; it may charge not to exceed $2 per 1,000 cu. ft. for gas for illuminating purposes, or $1.50 for gas used for fuel, until the population of city equals 50,000 inhabitants, when it may not charge more than $1.75 per 1,000 cu. ft.; and all "consumers for any quantity less than 1,000 cu. ft. shall be charged in the ratio which said part of 1,000 bears to said 1,000 cu. ft." In respect of the quality of the gas supplied it is stipulated that "said gas shall be made from a good quality of material, as free as possible from sulphur and *air*, and shall give as good a quality of light as is obtainable, and as is furnished to cities of similar sizes elsewhere."

Correspondence

[The Journal is not responsible for the opinions expressed by correspondents.]

An Experience in Oxide Purification.

The following interesting letter, which explains itself, is a copy of one forwarded by the subscriber to Mr. Charles Hunt, of Birmingham, England:

Launceston, Tasmania, August 17, 1891.

Chas. Hunt, Esq., Engineer Windsor Street Gas Works, Birmingham:

Dear Sir—Having read your paper on Oxide Purification, with much interest, I trust it will not be trespassing too much on your forbearance to read the result of experience of that method of purifying in this far-off island.

As briefly as possible the following gives the disposition of the existing manufacturing plant.

In a retort house 93 feet 4 in. long, 32 ft. wide, are placed 10 benches of sixes, 22 × 14 in. × 9 ft. D's, inside measurement, and a ⊔-shaped hydraulic main, 18 × 18 in., receives the tar and water as made and immediately discharges same. In connection with this main are White's automatic anti-dip valves (on a dry main) which have been at work over seven years, and during that time have given much satisfaction, relieving the house of blocked ascension pipes, diminishing the growth of carbon in the retorts as well as rendering possible an increased make of gas per ton. The lids or mouthpieces are all Morton's patent.

The gas travels along a 12 in. dry foul main and then to a horizontal condenser of 12 in. pipes, making up a total of about 1,100 feet run for a make of 250,000 ft. in 24 hours, allowing for the usual set-off for repairs. These condensers generally require cleaning every autumn, and this consists of drawing a 12½ in. steel wire brush through the pipes by means of a light chain worked by manual labor.

The exhausters consist of a single machine, 25,000 ft. capacity and a pair of 10,000's coupled at right angles and used respectively during winter and summer. A 4-horse power vertical and 10-horse power (the latter one of a pair when extensions demand) are both by Tangyes, and they, in their turn, work summer and winter, driving exhauster, coke breaker, lathes and smith's blower. Boilers also in duplicate.

A Livesey 250,000 ft. and a Walker 500,000 ft. washer come next in order, and through the latter a fine stream of water is fed and overflows to the smaller machine.

The purifiers, erected to take the place of smaller ones, were bought when iron was low, and were built as large as possible.

The size of each is 22 × 13 × 5 ft., and all work with a center valve having 12-in. connections, which allows working 3 on and 1 off, and then all four on, which is its normal condition. These vessels were by C. & W. Walker, and are a good set.

When oxide was first used by me, a portion was placed in a set of 8 × 8 × 4 ft. vessels, whilst 2 larger vessels were being erected and attached to the center valve. A larger quantity was added to 20¾ tons of O'Neill's oxide, consisting of 55¾ tons of Mittagong oxide from New South Wales. The total of 76½ tons was mixed with 215 bushels of Kauri pine sawdust procured from a large breaking down saw.

The amount of gas passed through this oxide is 305½ million feet, and since the first large vessel was charged (February 7, 1887) till it was taken out again (June 24, 1891), 211 millions have been sent through, and all the purifiers had to be changed on account of back pressure. The following are the changes: A, February 7, 1887; B, January 12, 1888; C, June 7, 1889; D, July 8, 1890; A, second time, June 24, 1891. As to any discoloration being seen on a test paper, I send you half of one that was placed (September 17, 1890) in a glass test vessel taking its supply from the town main on its way to a jet photometer which requires 50 ft. per 24 hours.

Being anxious to find the amount of sulphur other than SH^2, tests were made in a Sugg-Harcourt color test, and although in the instructions 40 measures represent, with the addition of 8 grains, 500 grains in 100 cubic feet, yet more than the faintest discoloration of the solution failed to appear after the passing of 40 × 50 = 2,000 measures.

Up to the present time *oxide and labor* have cost 1.90d. per 1,000 ft. of gas purified, and it is reasonable to anticipate that when the other three boxes have come round for their turn this amount will be lower than now, say under 1.50d. In the future, oxide can be purchased in the Island at one-fourth the price of what was paid for the material in use, reducing the cost for oxide and labor to below 0.50d.

Upon analysis of the oxide taken out, as tested by a small apparatus devised by Mr. Andrew Stephenson and described in Newbigging's Handbook, last edition, page 378, the following results were found:

	Numbers of Samples.		
	1.	2.	3.
Moisture at 212° F.....	6.0	6.0	6.0
Sulphur.....	62.0	60.0	63.0
Residue.....	32.0	34.0	31.0
	100.0	100.0	100.0

As tarry matter was undoubtedly present in the sulphur, the amount would be a little less than above stated.

There is no air inserted at any part of the plant for assisting the revivification of the oxide, and the average of the quarterly returns of the last six years, tested on an Evans' photometer, using a Sugg's London Argand burner No. 1, with 7 in. × 1⅛ in. diameter chimney, showed the gas to be of an illuminating power of 18.50 candles.

Our general average of gas per ton of coal, *without shale*, is 9,830 feet, and quality, 18.60 candles.

I am sending a press copy of this to the American Gas Light Journal's office, as I promised them I would some little time ago.

With kind regards, yours fathfully, T. S. Cleminshaw.

The Market for Gas Securities.

We are unable to report any change in the market value of city gas shares for the week, but the disposition of holders is such that no transfers are likely to be made at the ruling bid rates. Consolidated opened to-day (Friday) at 98⅛ bid, sellers holding out for 99½. The Standard Company's position in the Rosenheimer warfare need not give its shareholders any trouble. The works have not been shut down, nor will they be.

Over in Brooklyn the situation remains unchanged, and holders are content to bide their time. The following circular issued by President Morgan, of the Nassau Company, on the 8th inst., explains itself:

At a special meeting of our Board of Directors, held this day, it was unanimously resolved that, in order to provide funds necessary for enlarging the works of the Company, it is resolved, under authority given by the stockholders at a meeting held March 6, 1889, to increase the capital stock by the issue of 40,000 shares of $25 each, under the direction of the Board of Directors.

The officers of the Company are hereby authorized to invite subscriptions for 10,000 shares of $25 each, at par, from our stock holders of record October 8, 1891.

Stockholders will be entitled to subscribe for 25 per cent. of as many shares as were standing in their names at the above date.

No fractional shares will be issued.

Subscription list to remain open until November 9, 1891, inclusive, after which date no subscription will be received.

Payments to be made one half upon filing application, and the balance January 4, 1892, when certificates of new stock will be issued as of that date.

In the event of the failure to make second payment at maturity the first payment will be forfeited.

You are entitled to subscribe for twenty shares, and if you desire to do so please sign the inclosed application and return it to us with check for $250, and upon receipt of the same due acknowledgement will be made.

Yours respectfully,
H. P. MORGAN, President.

In out-of-town shares, we note continued strength in Chicago gas, while Laclede is weaker. Some inquiry was made for Bay State bond issues, at an advance over last quotations.

Gas Stocks.

Quotations by Geo. W. Close, Broker and Dealer in Gas Stocks,

16 WALL ST., NEW YORK CITY.

OCTOBER 19.

☞ All communications will receive particular attention.
☞ The following quotations are based on the par value of $100 per share.

	Capital.	Par.	Bid	Asked
Consolidated	$35,430,000	100	98½	99½
Central	500,000	50	—	90
" Scrip	220,000	—	95	100
Equitable	4,000,000	100	119	121
" Bonds	1,000,000	—	106	108
Harlem, Bonds	170,000	—	—	—
Metropolitan, Bonds	658,000	—	110	115
Mutual	3,500,000	100	119	121
" Bonds	1,500,000	—	100	102
Municipal, Bonds	750,000		—	—
Northern		50	—	—
" Bonds	150,000	—	—	100
Standard Gas Co—				
Common Stock	5,000,000	100	40	45
Preferred	5,000,000	100	—	82
Yonkers		50	112	—
Richmond Co., S. I.	346,000	50	—	—
" Bonds	20,000	—	—	—
Gas Co's of Brooklyn.				
Brooklyn	2,000,000	25	101	—
Citizens	1,200,000	20	88	90
" S. F. Bonds	320,000	1000	100	103
Fulton Municipal	3,000,000	100	111	112
" Bonds	300,000		100	105
Peoples	1,000,000	10	64	—
" Bonds (7's)	368,000	—	100	—
" " (6's)	94,000	—	100	—
Metropolitan	870,000	100	92	—
" Bonds (5's)	70,000	—	—	—
Nassau	1,000,000	25	130	—
" Ctfs	700,000	1000	98	100
Williamsburgh	1,000,000	50	105	—
" Bonds	1,000,000	—	105	109
Out of Town Gas Companies.				
Boston United Gas Co.—				
1st Series S.F. Trust	7,000,000	1000	84	86
2d " " "	3,000,000	1000	70	74

WANTED,
A Small Gas Exhauster,
With 4 or 6 inch connections. Must be in good condition.
SANTA ANA GAS AND ELECTRIC CO.,
854-4 Santa Ana, Cal.

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Stamps the dials, pointers, and number of the meter on a card direct from the meter. Impossible for the meter reader to average statement or to make a mistake.
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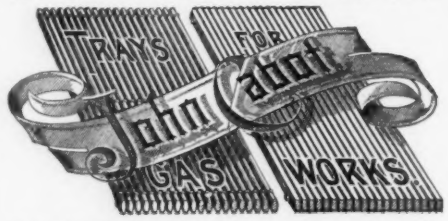

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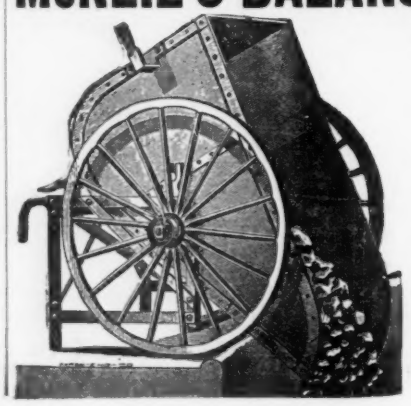

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Will be Held at New York, Oct. 21, 22 and 23.

HEADQUARTERS AT THE HOLLAND HOUSE, Fifth Ave. & 30th St.

Each application for membership (Active or Associate), or for transfer from Associate to Active, must be completed and in the hands of Acting Secretary at least ten days before meeting. Each application must be endorsed by two Active Members of Association to be complete.

No payment for initiation fee required in advance.

"To be *eligible* as an *Active Member* a person must be a president, secretary, treasurer, engineer, consulting engineer, or superintendent of a gas company, or a manager of a gas works."

"*Associates* shall be persons holding a responsible position in a gas works, or persons whose pursuits constitute branches of gas engineering, or who are otherwise qualified to assist in promoting the objects of the Association."

Application blanks may be obtained of the Acting Secretary,

ALEX. C. HUMPHREYS, Drexel Building, Phila., Pa.

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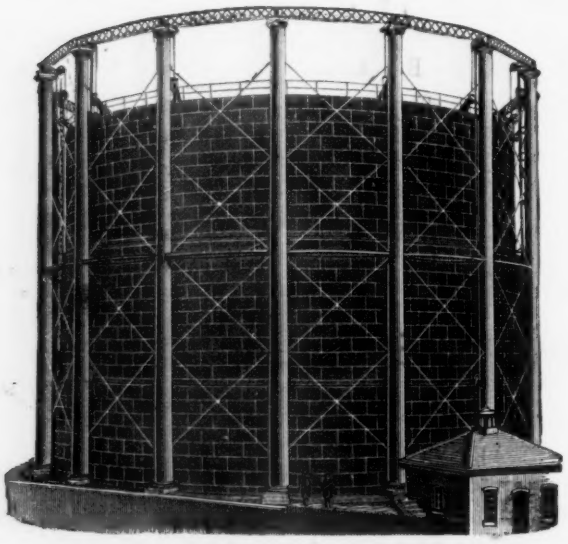

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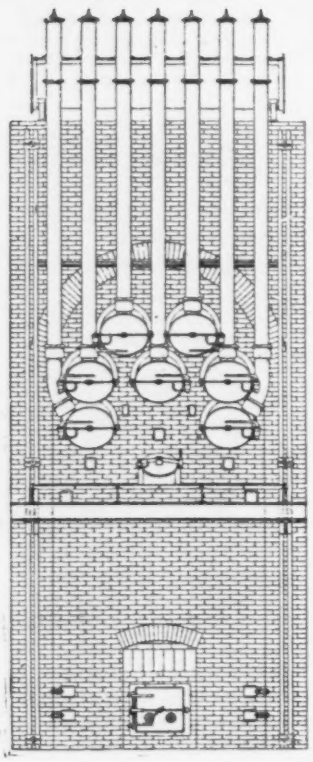

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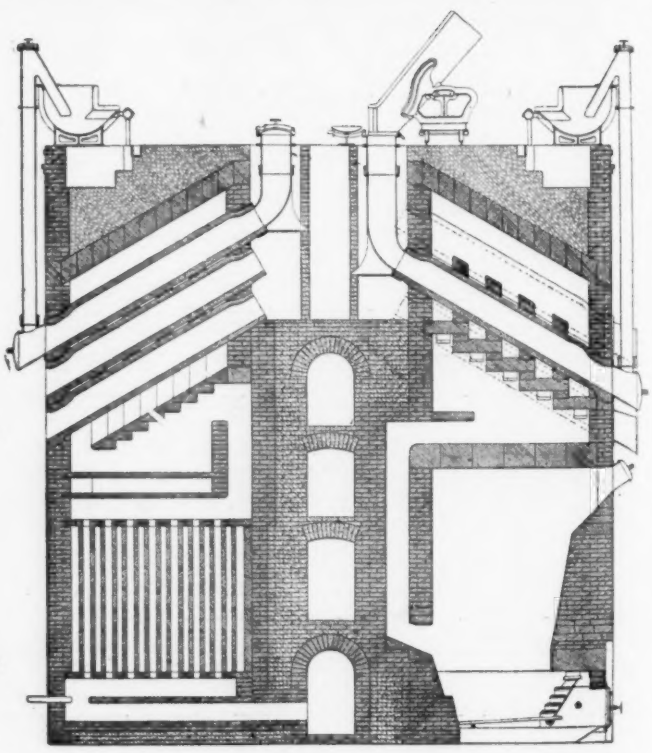

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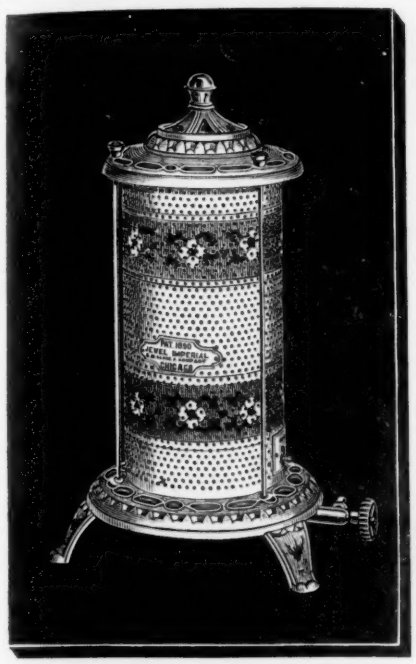

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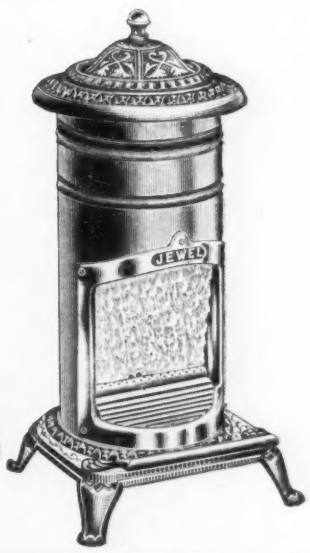

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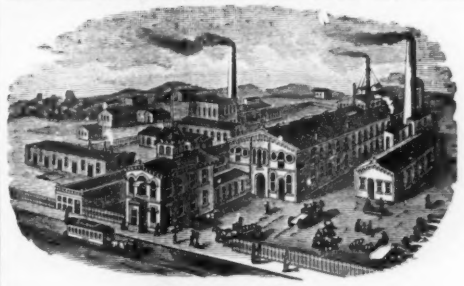

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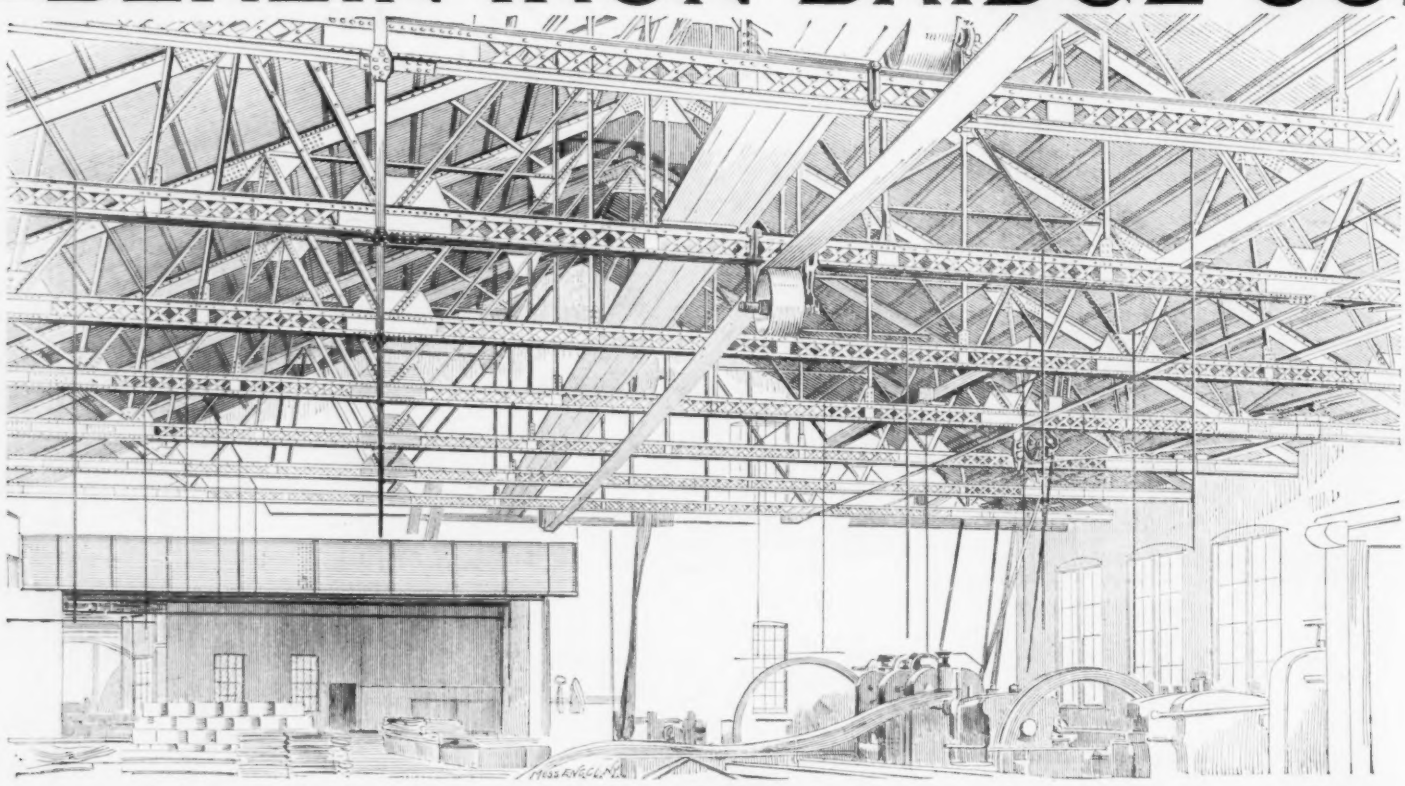

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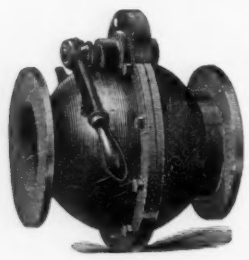

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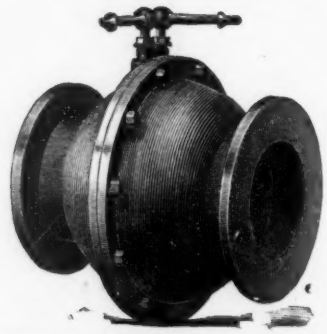

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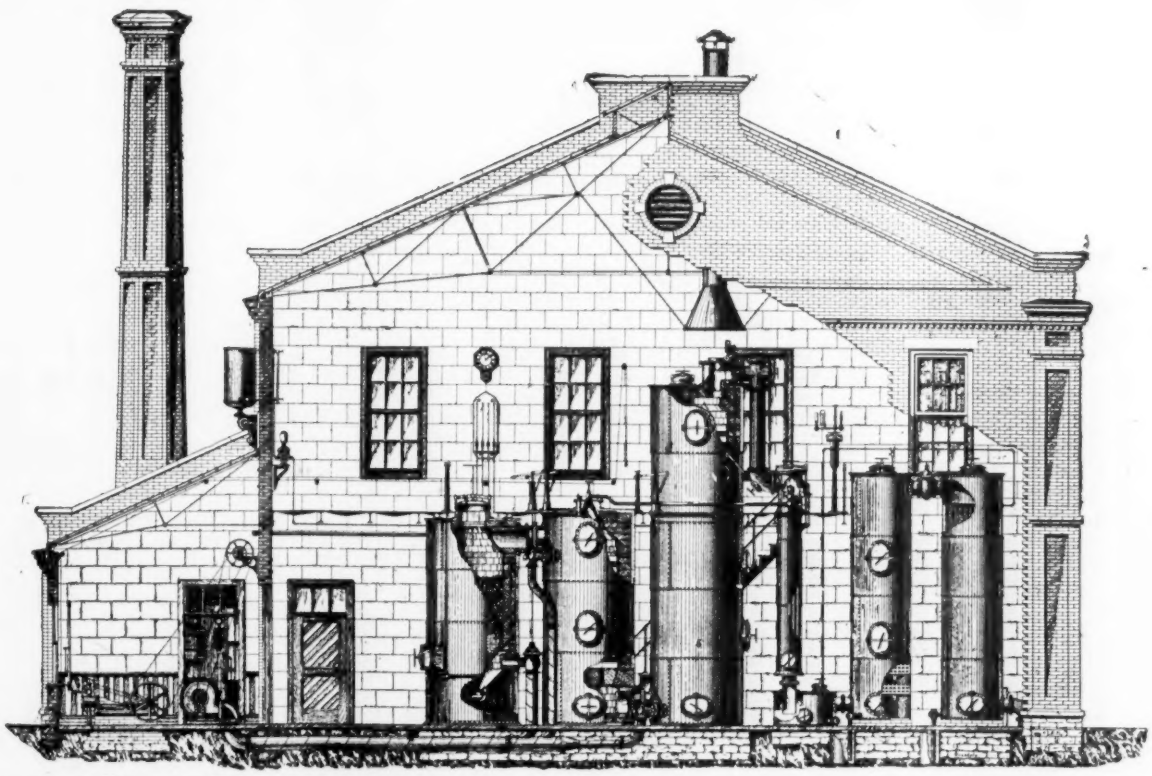

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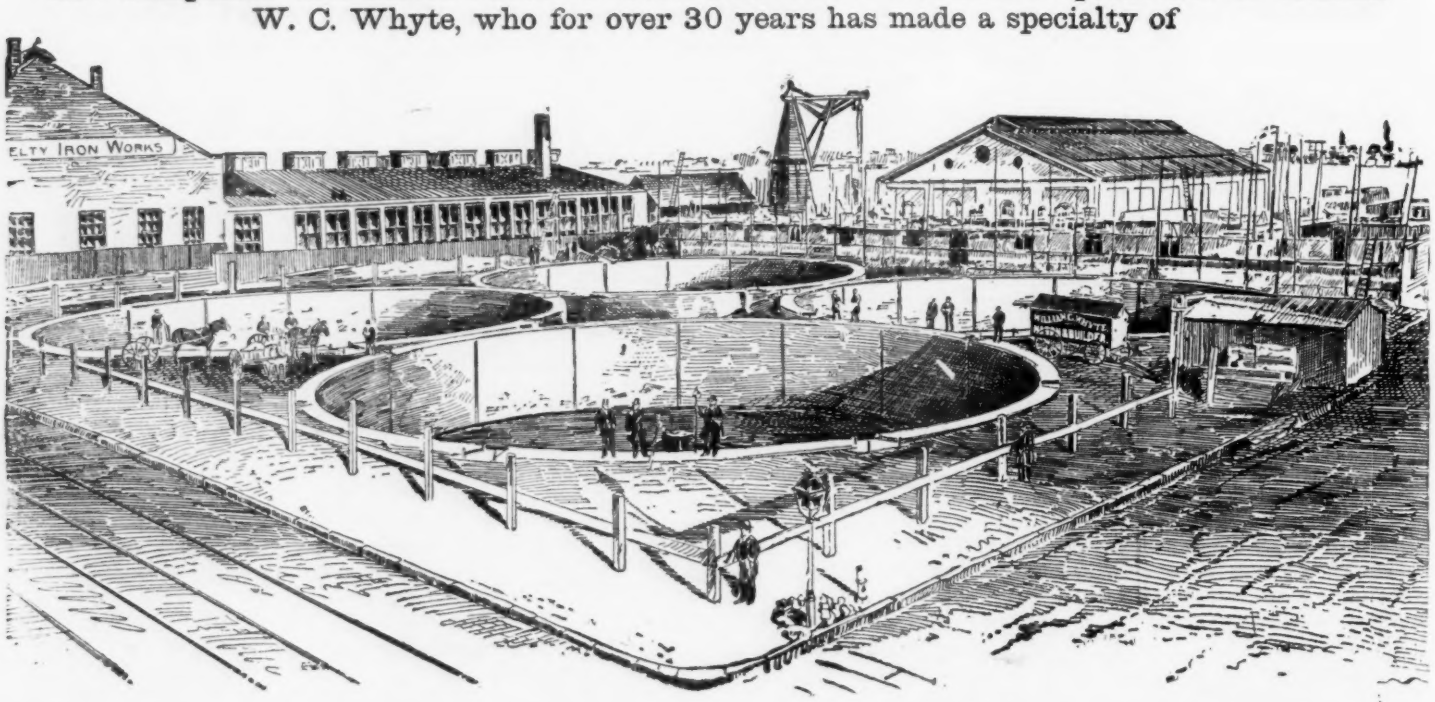

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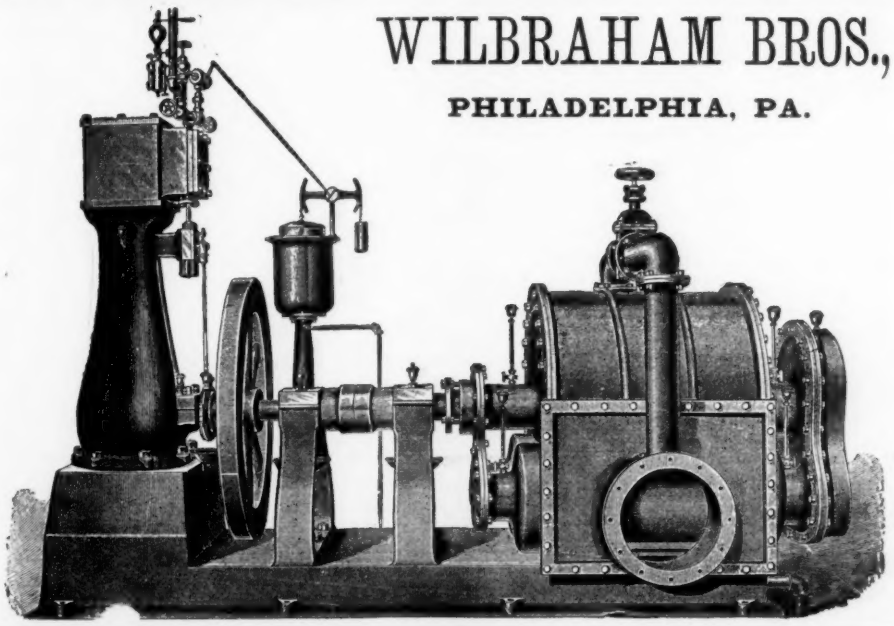

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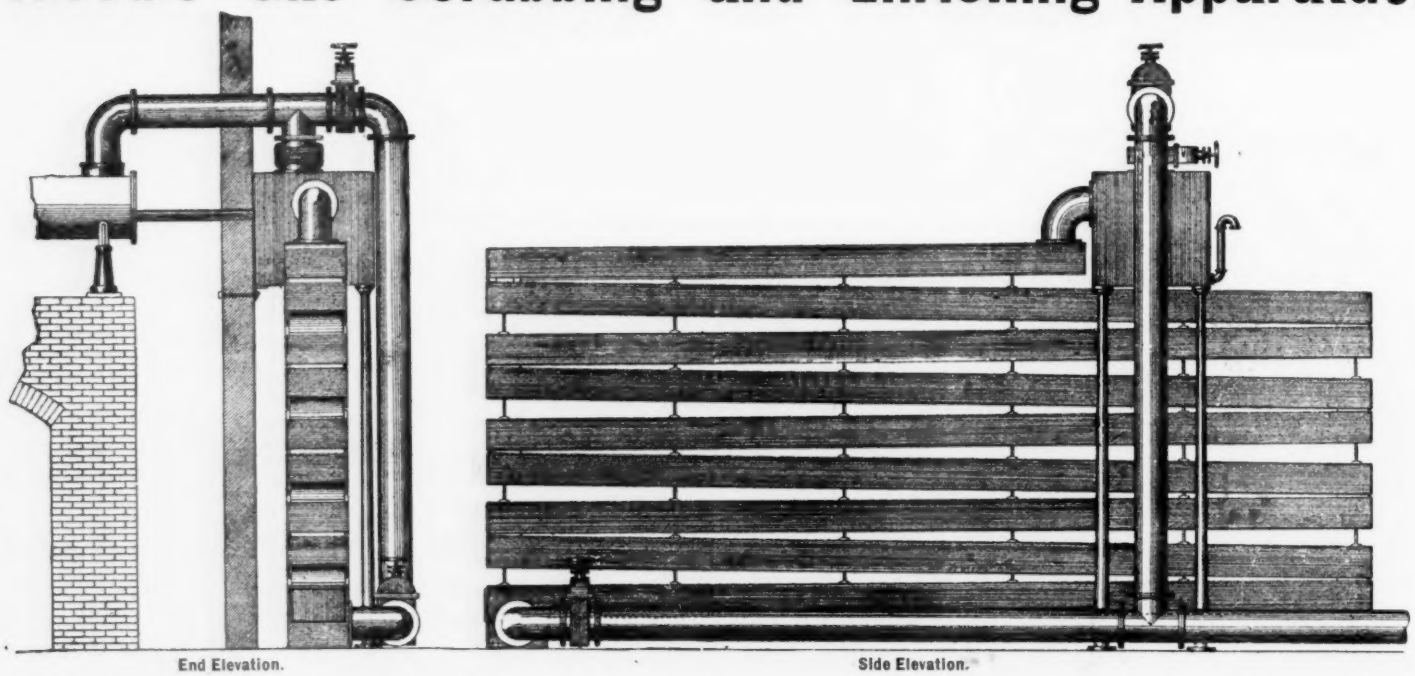

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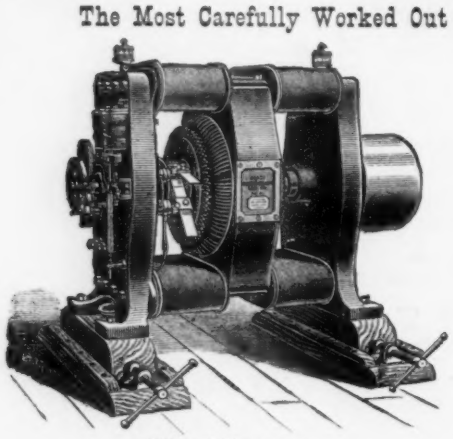

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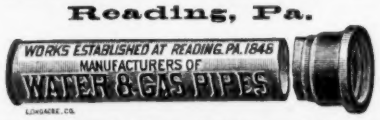

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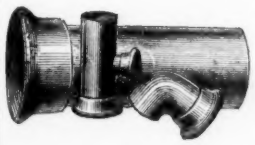

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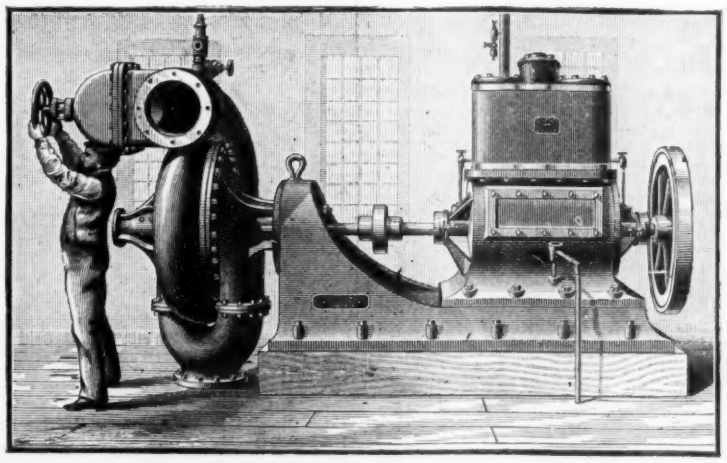

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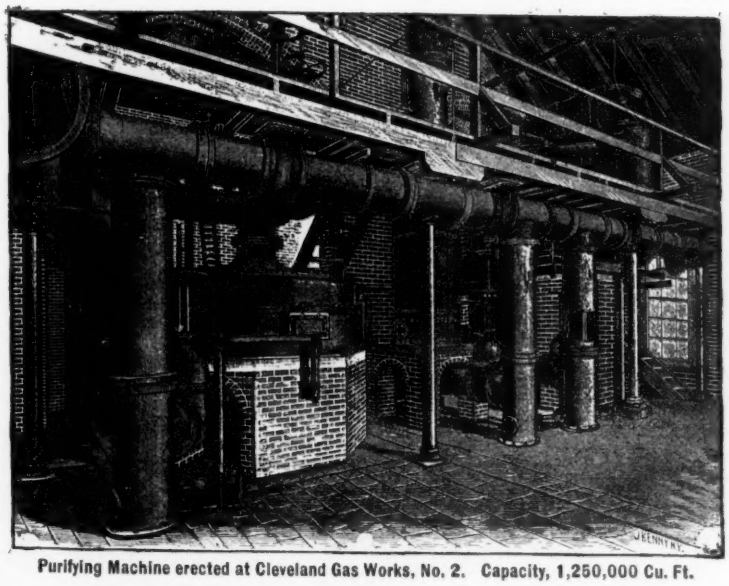

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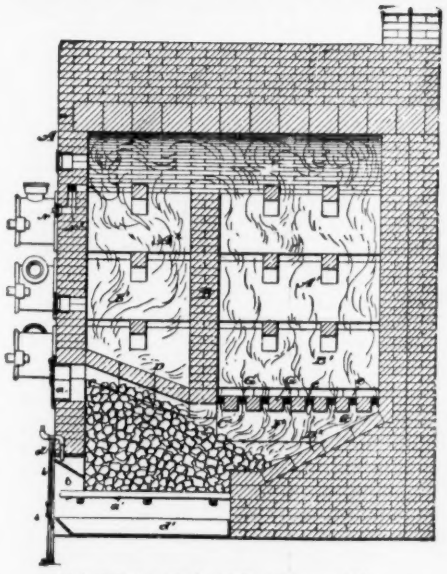

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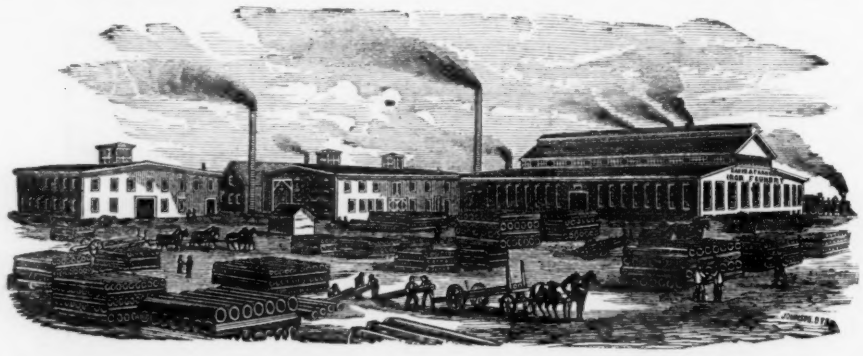

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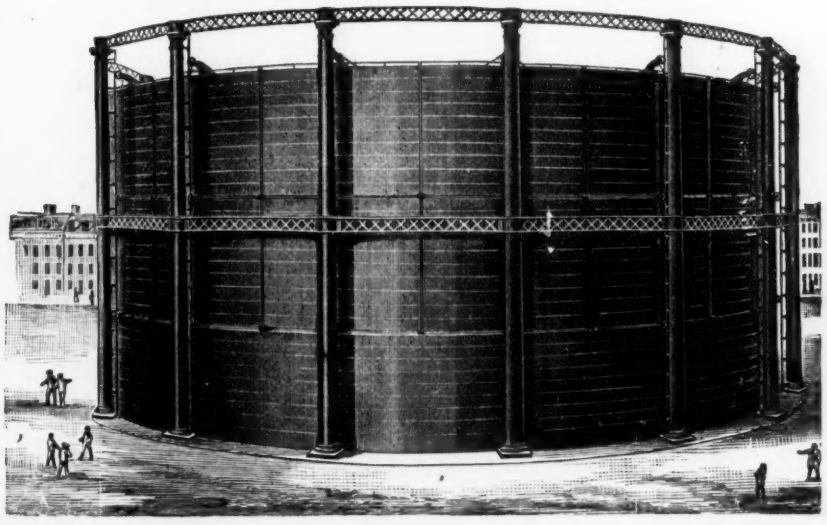

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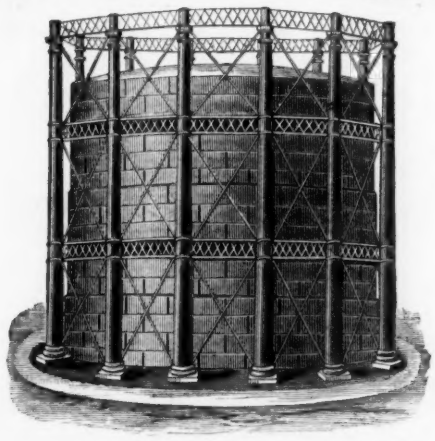

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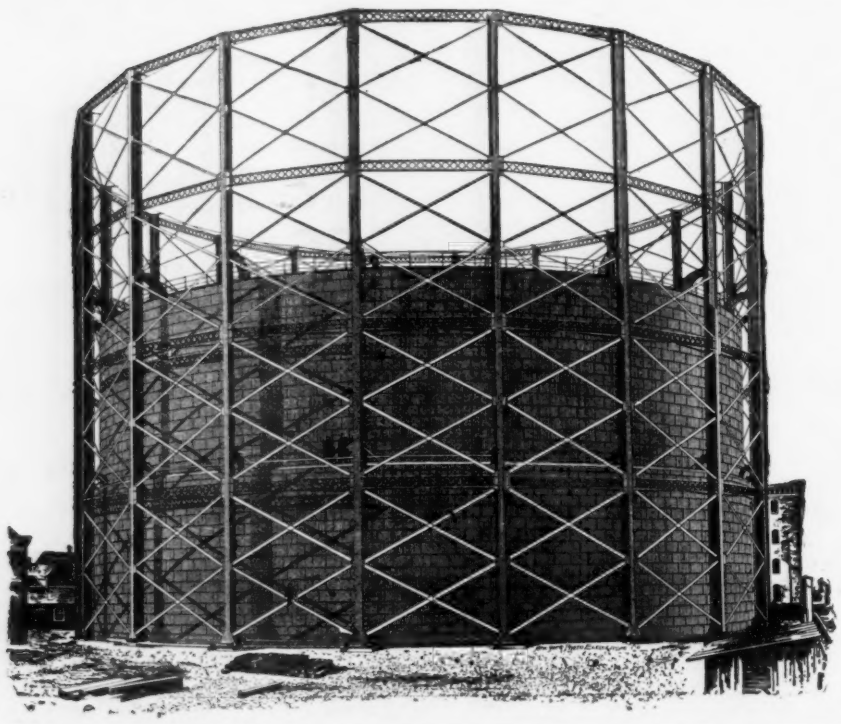

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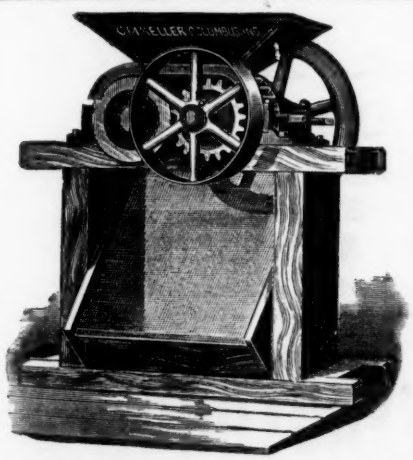

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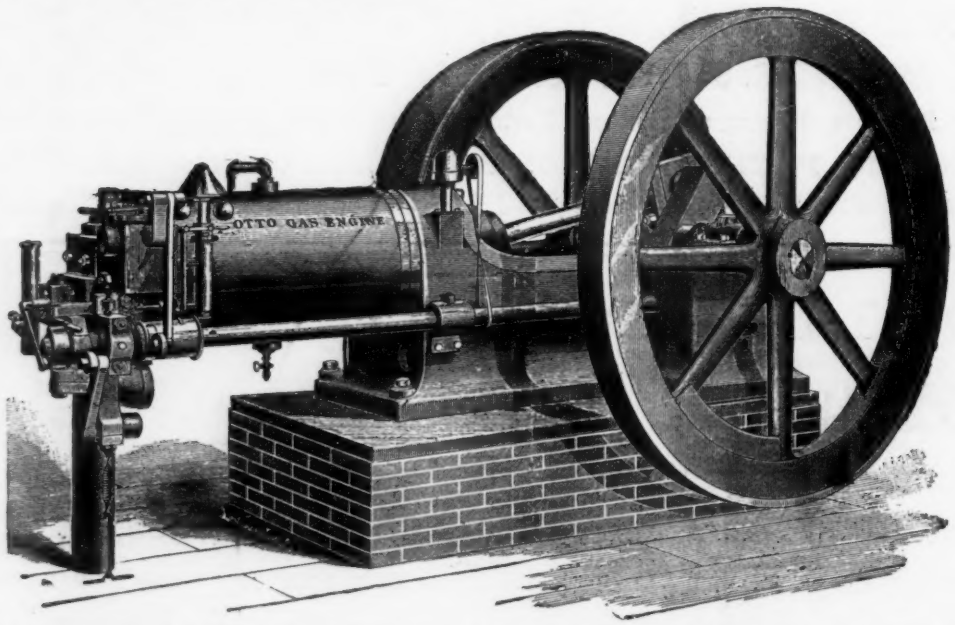

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